BHSGB142-AM 01/05

Buderus
HYDRONIC SYSTEMS

# Applications Manual for
## Buderus GB142 Wall Hung Heaters

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# 1 INTRODUCTION

This GB142 Applications Manual is intended to present some of the most common applications of the wall-hung Buderus GB142 heater for use in hot water space heating applications. Applications are shown with both piping and corresponding electrical schematics. Auxiliary equipment depicted does not necessarily represent any one particular manufacturer or specific model number. There are a wide variety of techniques, practices and piping strategies possible with hydronic heating systems and it is the responsibility of the installing contractor to determine the most suitable arrangement for his application.

In an effort to simplify piping and electrical diagrams, only Diagrams 1P and 1E depict the complete details with respect to piping and wiring of an indirect hot water tank. This part is left off all subsequent drawings for clarity purposes.

Basic information regarding vent installation, clearances, condensate piping and termination locations are included as well.

Although this manual covers many common applications for our equipment, system possibilities are virtually endless. Should you encounter an application that is not covered in this manual or have any questions regarding any of its content, we encourage you to contact your local sales rep or us directly at Buderus Hydronic Systems, USA.

# 2 DESCRIPTION OF MAIN COMPONENTS

## PRE-PIPED MANIFOLD AND PUMP SETTINGS

All GB142 are standard supplied with a pre-piped and wired heater manifold with pump to easily facilitate required primary/secondary piping for the installing contractor. Shut-offs, relief valve, pressure and temperature gauge, purge station on the supply leg and built-in flow check and a Grundfos UPS15-58 3-speed heater pump are included on the return side of the manifold. (Refer to Diagram 1P).

Table 1 show ΔT values for different speed settings on the UPS15-58 pump for each GB142 model.

**Table 1: Max Heater ΔT (ºF) Values for UPS 15-58 Manifold Pump**

| Heater Model | Speed 1 | Speed 2 | Speed 3 |
|---|---|---|---|
| **GB142/24** | 26 | 20 | 17 |
| **GB142/30** | 33 | 25 | 21 |
| **GB142/45** | 42 | 32 | 28 |
| **GB142/60** | N/A | 43 | 32 |

Integrated heater controls will automatically reduce the heater input once the heater ΔT exceeds 45 ºF regardless of feedback single from the RC10 control. Complete burner shut-down will always take place before ΔT exceeds 99 ºF. The maximum flow rates are as follows: GB142/24 or /30: 11 GPM, model /45: 15 GPM, model /60: 20 GPM.

## PUMP SIZING FOR BUDERUS INDIRECT TANKS

All heating zones are piped directly off the supply (left) side of the heater manifold; with heating returns combined on the return (right side). Piping connections for an indirect tank charging pump (PS) are included on the heater manifold. Refer to Tables 2 and 3 for tank pump recommendations for different Buderus indirect tanks. All piping to and from the indirect needs to be at least 1". Use a minimum number of elbows and keep piping lengths to a minimum.

**Table 2: Indirect Pump Recommendations for GB142/24 and /30 models.**

| | GB142/24 | | | GB142/30 | | |
|---|---|---|---|---|---|---|
| **Tank Model** | **Grundfos** | **Taco**** | **B & G** | **Grundfos** | **Taco**** | **B & G** |
| **S120** | UP14-42 3* | 007 | NRF22 | UP26-64 | 0012 | PL30 |
| **ST150** | UP26-64 | 0011 | PL30 | UP26-64 | 0013 | PL35 |
| **ST200** | UP26-64 | 0014 | PL30 | UP26-64 | 0011 | PL45 |
| **ST300** | UP26-64 | 0014 | PL30 | UP26-64 | 0011 | PL30 |
| **ST400** | | 0011 | PL45 | | | |
| **SU500** | UP26-64 | 0017 | PL30 | UP26-64 | 0011 | PL45 |

* Refers to Grundfos UP15-42 w/ built-in flow check and speed setting

** Refers to Taco 007 without built-in flow check

**Table 3: Indirect Pump Recommendations for GB142/45 and /60 models.**

| | GB142/45 | | | GB142/60 | | |
|---|---|---|---|---|---|---|
| **Tank Model** | **Grundfos** | **Taco**** | **B & G** | **Grundfos** | **Taco**** | **B & G** |
| **S120** | UP26-64 | 0014 | PL36 | UP26-64 | 0011 | PL30 |
| **ST150** | UP26-99 | | PL36 | | 0013 | PL36 |
| **ST200** | UP26-99 | | PL36 | | 0013 | PL36 |
| **ST300** | | 0013 | PL36 | | | PL36 |
| **ST400** | | | | | | |
| **SU500** | | | PL36 | | | |
| **SU750 ***** | UP26-64 | 0011 | PL30 | | 0011 | PL36 |
| **SU1000 ***** | UP26-64 | 0012 | PL30 | UP26-64 | 0012 | PL30 |

* Refers to Grundfos UP15-42 w/ built-in flow check and speed setting

** Refers to Taco 007 without built-in flow check

*** SU750 and SU1000 tanks are non stock. Allow 6 to 8 weeks for delivery.

Tables 4 and 5 show pump recommendations for 2 and 3 tank systems operating off a single GB142 heater. Tank pumps are placed in parallel with each tank having its own pump. The GB142 DHW sensor is placed in one tank; a high limit aquastat is to be installed in other tanks and wired in series with the pump power to prevent over heating. Domestic water must be drawn equally from the tanks.

**Table 4: Two Tank Systems**

| | GB142/30 | | | GB142/45 | | | GB142/60 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Tank** | **B & G** | **Grundfos** | **Taco** | **B & G** | **Grundfos** | **Taco** | **B & G** | **Grundfos** | **Taco** |
| **ST150** | PL50 | 15-42 | 009 | PL30 | 26-64 | 0014 | PL30 | 26-64 | 0011 |
| **ST200** | PL50 | 15-42 | 009 | PL30 | 26-64 | 0014 | PL30 | 26-64 | 0011 |
| **ST300** | PL50 | 15-42 | 009 | PL30 | 26-64 | 0014 | PL30 | 26-64 | 0011 |
| **ST400** | PL50 | 15-42 | 009 | PL30 | 26-64 | 0014 | PL30 | 26-64 | 0011 |

**Table 5: Three Tank Systems**

| | GB142/30 | | | GB142/45 | | | GB142/60 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Tank** | **B & G** | **Grundfos** | **Taco** | **B & G** | **Grundfos** | **Taco** | **B & G** | **Grundfos** | **Taco** |
| **ST150** | NRF22 | 15-42 | 008 | PL30 | 26-64 | 009 | PL50 | 26-64 | 0014 |
| **ST200** | NRF22 | 15-42 | 008 | PL30 | 26-64 | 009 | PL30 | 26-64 | 0014 |
| **ST300** | NRF22 | 15-42 | 008 | PL30 | 26-64 | 009 | PL30 | 26-64 | 0014 |
| **ST400** | NRF22 | 15-42 | 008 | PL30 | 26-64 | 009 | PL30 | 26-64 | 0014 |

Electrically the GB142 has 120 V connections for the heater manifold pump PK (4 Amp max), indirect tank charging pump PS and DHW recirculation pump PZ (Max Amp draw of 5 Amp for PS and PZ combined).

The low voltage side is equipped with the following terminals:

1) RC terminals (orange color) for an indoor room sensor for firing and modulating the burner. (RC10 control standard supplied with GB142).
2) FA optional outdoor sensor terminals (blue color) connections (requires RC34 controller; available Fall 2005).
3) WA T-T terminals (light green color) connections for optional conventional thermostat.
4) FW DHW tank sensor terminals (light gray color) for sensing tank water temperature. (Tank sensor standard supplied with GB142).
5) EV terminals (red color) for connecting of an optional safety such as LWCO, manual reset high limit or any other type of external limit circuit.

## BC10 CONTROLLER

A BC10 control panel is installed in every GB142 which includes a diagnostic display, status indicator lights, dials for DHW and maximum heater temperature as well as programming and diagnostic access buttons. A detailed description of all diagnostic and status codes is provided with the GB142 Installation and Service Manual.

## RC10 ROOM CONTROLLER

A RC10 room controller is provided with every GB142 to provide indoor reset and pin point precision control back to the BC10. The RC10 must be installed in a reference location for indoor feedback to the GB142. The RC10 will control the modulation and heater water temperature based on maintaining desired indoor comfort levels. The RC10 is typically placed in the main living area for optimum comfort and accurate temperature control. Give careful consideration to the placement of the RC10 sensor.

The use of the RC10 indoor room controller is shown in a number of diagrams to achieve maximum comfort and efficiency from the product. Suggested timings of the post purge for the boiler pump (PK) are shown on each wiring diagram.

***Note:*** **Never** connect a RC10 control and a thermostat or end switch at the same time.

## SPACE HEATING OPERATION:

The PK boiler pump operates and the burner fires on a call for heat from the T-T terminal or from the RC10 controller. Use only T-T connections or RC terminals, **but do NOT use both at the same installation**. Once the call for heat is satisfied, the PK pump continues to operate through an adjustable programmable post-purge cycle before shutting down. The PK pump can also set to operate continuously for up to 24 hours after the last call for heat.

## DHW HEATING OPERATION:

A call for heat from the FW (DHW) sensor brings the control into DHW priority, shutting off the PK pump, firing the boiler to maximum temperature and operating the PS pump. Internal logic includes an anticipative DHW heating cycle with automatically adjusting post purge feature and reduces burner modulation rate.

# 3 DIMENSIONS, CONNECTIONS and CLEARANCES

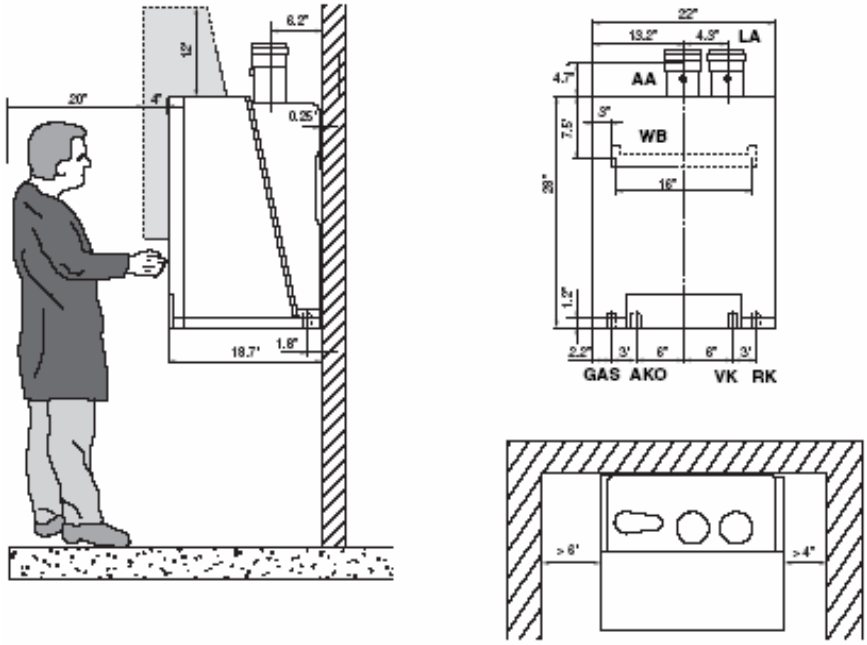



Fig. 1: Dimensions and Connections for GB142/24 and /30.

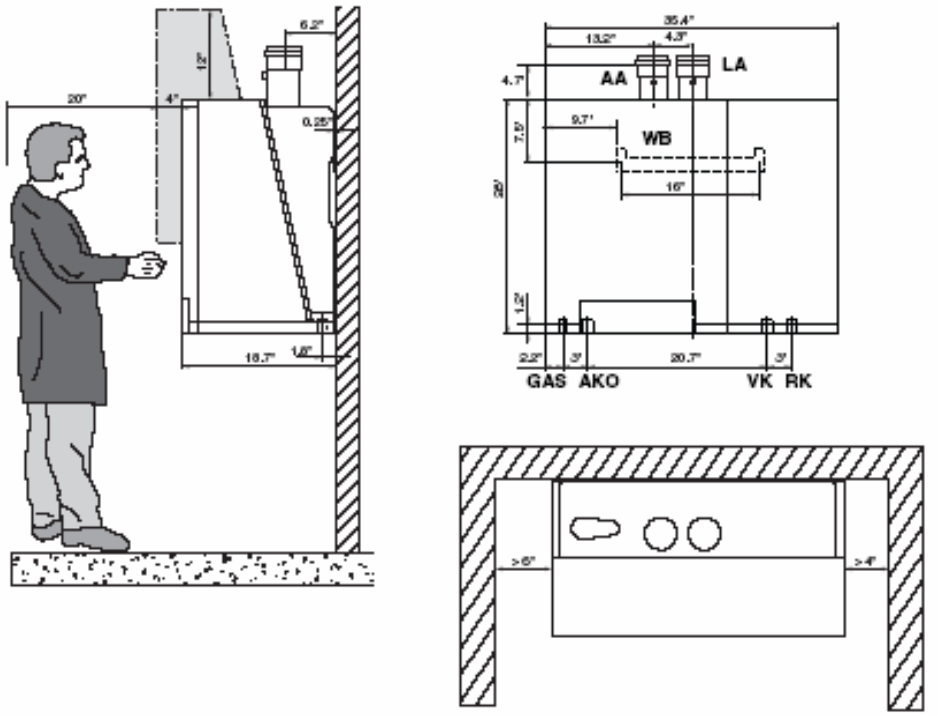



Fig. 2: Dimensions and Connections for GB142/45 and /60.

# 4 VENTING GUIDELINES

## VENTING GUIDELINES

The GB142 is suitable for side-wall as well as vertical venting using field supplied 3" PVC or CPVC pipe in compliance with ANSI, ASTM D1785 (schedule 40 PVC), F441 or D2665 (PVC-DWV). Cement and primer must comply with ASTM D2564. For Canada, use CSA or ULC certified PVC or CPVC pipe, fittings and cement. **Foam core PVC pipe can not be used.**

***Note:*** Installation must comply with local requirements/codes, National Fuel Gas Code, ANZI Z223.1 (USA installations) CSA B149.1 or B149.2 (Canadian installations)

***Note:*** Installing contractor must install condensate tee (supplied by Buderus) immediately after the first 90 degree flue elbow. Condensate must be drained into a condensate pump or appropriate drain.

The GB142 is approved for both Direct Vent (sealed-combustion - see ***FIG. 3A*** for termination location) as well as Direct Exhaust (non sealed-combustion - see ***FIG. 3B*** for termination location) operation in both a horizontal and vertical vent arrangement. For room air applications, follow National Fuel Gas Code to ensure ample combustion air. All PVC venting material is approved for 0" clearance to combustibles for venting of the GB142 boiler.

**Table 6: Maximum Equivalent Vent Lengths**

| Model | Max Eq. Intake Length (ft) | Max Eq. Exhaust Length (ft) |
|---|---|---|
| GB142/24, /30, /44 | 100 | 100 |
| GB142/60 | 60 | 60 |

**Table 7: Friction Loss Equivalent for Fittings**

| Fittings or Piping | Equivalent Length (ft) |
|---|---|
| 45 ºElbow | 3 |
| 90º Elbow | 5 |
| Optional Concentric Vent Kit | 3 |

**Fig. 3A**

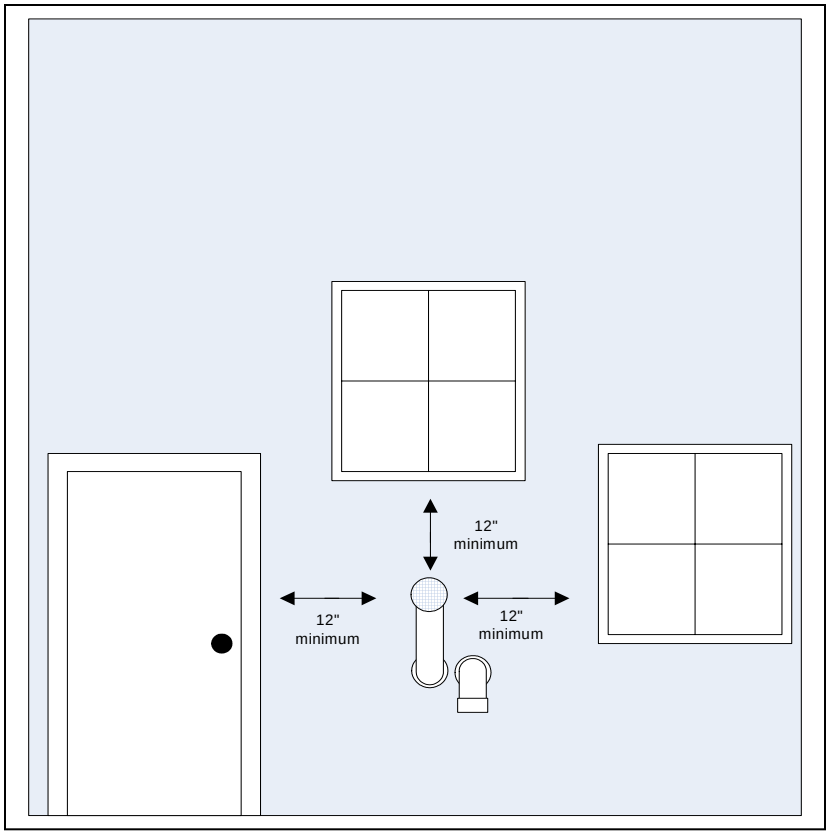
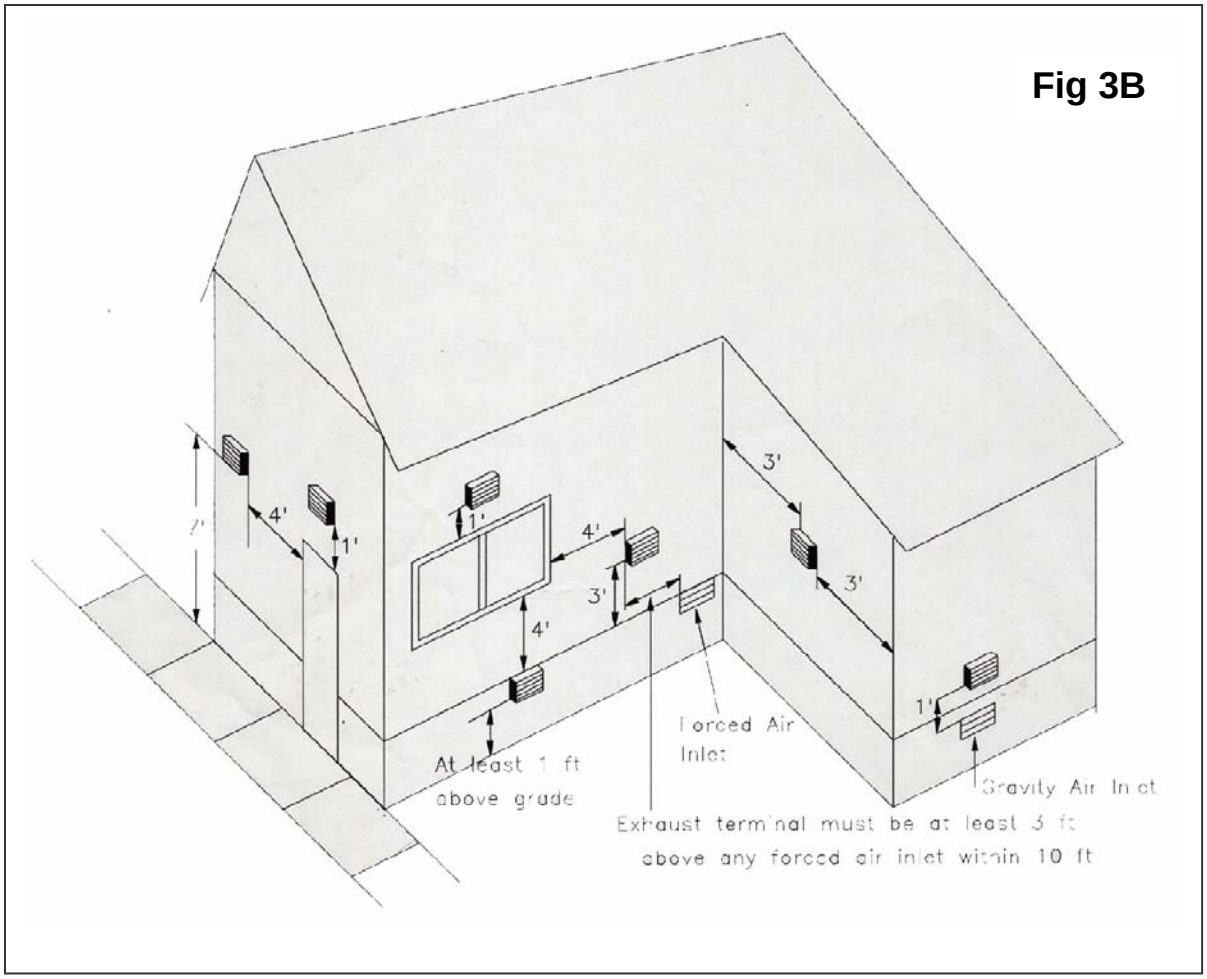

12"
minimum
12"
minimum
12"
minimum

**Fig 3B**


4'
1'
7'
1'
4'
3'
4'
3'
3'
1'
At least 1 ft
above grade
Forced Air
Inlet
Gravity Air Inlet
Exhaust terminal must be at least 3 ft
above any forced air inlet within 10 ft

## DIRECT VENT/SEALED COMBUSTION & DIRECT VENT/NON-SEALED COMBUSTION TERMINATION GUIDELINES

WARNING: Follow these instructions when determining vent termination location to avoid possibility of severe personal injury, death, substantial property damage or cross contamination of combustion air. Gas vent extending through an exterior wall shall not terminate adjacent to the wall or below building extensions such as eaves, parapets, balconies or decks. Failure to comply could result in severe personal injury, death or substantial property damage. Locate the concentric vent/air termination using the following guidelines.

- The total length of piping for vent or combustion air should not exceed the limits in Table 6 for maximum output.
- One must consider the immediate environment when locating the vent/air termination. Gases will form a white plume in winter. Plume could obstruct window view. Prevailing winds could freeze condensate and cause water/ice buildup on building, plants or roof. Do not terminate vent in window well, stairwell, alcove, courtyard, or other recessed areas.
- Maintain Minimum Clearances below to prevent potential problems;
    1. Vent must terminate at least 12 inches above grade, anticipated snow line or roof surface (Canada 18" minimum).
    2. Vent termination must be at least 7 feet above a public walkway.
    3. Vent must be 3 feet above any forced air intake within 10 feet.
    4. Vent must terminate at least 3 feet horizontally, from electric meters, gas meters, regulators, relief valves, and other equipment, and in no case above or below, unless a 3 feet horizontal distance is maintained
    5. Do not extend exposed vent pipe outside the building beyond recommended distance. Condensate could freeze and block vent pipe.
    6. Vent should terminate at least 3 feet away from adjacent walls, inside corners and below roof overhang.
    7. It is not recommended to terminate vent above any door or window, condensate can freeze causing ice formations.
    8. Do not use chimney as a raceway if another appliance or fireplace is vented into or through chimney.
    9. The exhaust vent must be pitched up toward the termination a minimum of ¼" in. per foot. Condensate must flow back to the Boiler freely, without accumulating in the vent.
    10. Multiple boiler vent terminations; See Venting application.

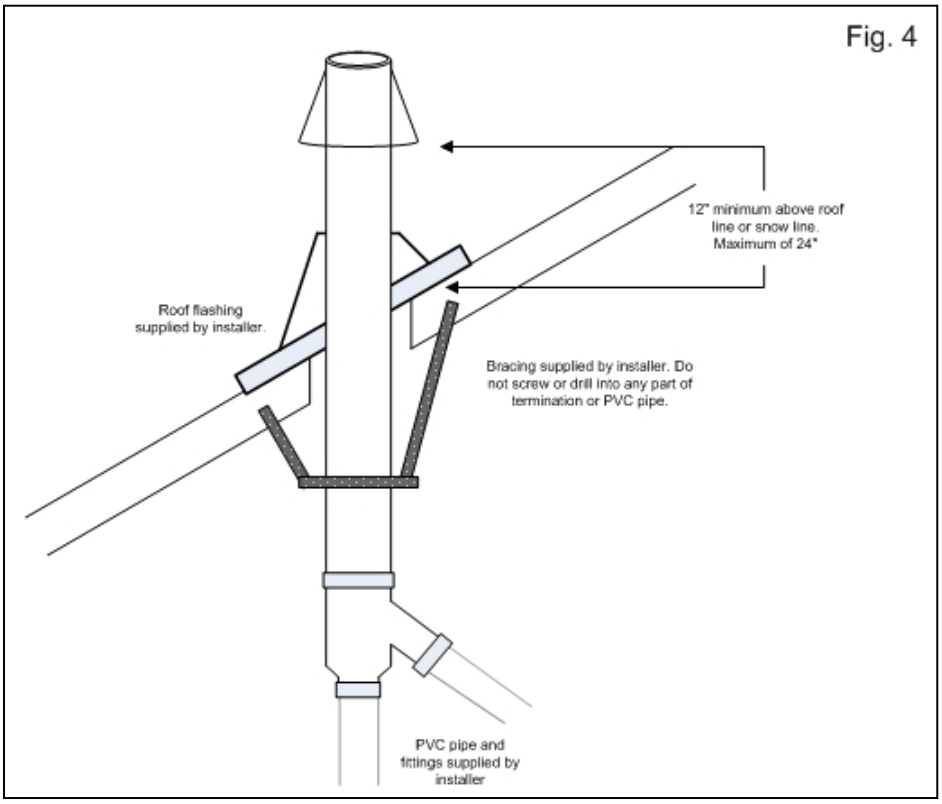
## EXHAUST AND INTAKE AIR PLACEMENT

### THROUGH THE ROOF PENETRATION — CONCENTRIC*:

1. Determine best location for vent/air termination using previous guidelines.
2. Cut a 5” hole to accommodate the 4½” diameter PVC pipe.
3. Cement termination concentric Y to 4½” diameter PVC pipe, then pass through roof penetration and field supplied roof boot/flashing.
4. Secure assembly to roof structure with field supplied metal strapping or equivalent support material.
5. Insert smaller 2½” PVC vent exhaust pipe into larger 4½” diameter combustion air pipe ensuring PVC exhaust vent pipe is properly cement into concentric Y.
6. Cement vent exhaust pipe and air inlet pipe onto concentric vent termination.
7. Concentric vent termination cannot be extended beyond manufactured length.
8. Concentric vent termination may be cut to desired length.
9. Concentric vent shall terminate at least 12 inches above snow line but not more 24 inches above roof surface. (see **FIG.4** and **FIG. 5** for details)
10. Operate heater through one complete cycle and check for flue gas leakage.
11. Refer to fig. 6 for multiple “Through the roof” installations and maintain a 12” center-to-center distance.

** Buderus Part Number: BRYKGAVT0602CVT*

Fig. 4


12" minimum above roof line or snow line. Maximum of 24"
Roof flashing supplied by installer.
Bracing supplied by installer. Do not screw or drill into any part of termination or PVC pipe.
PVC pipe and fittings supplied by installer

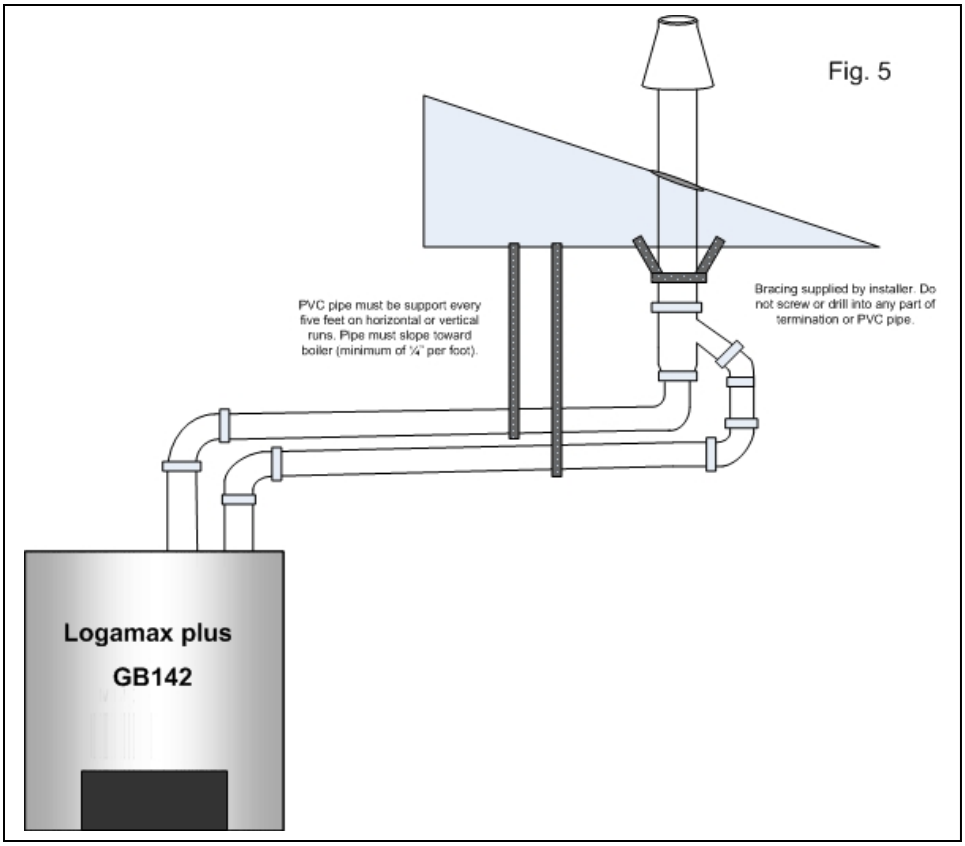
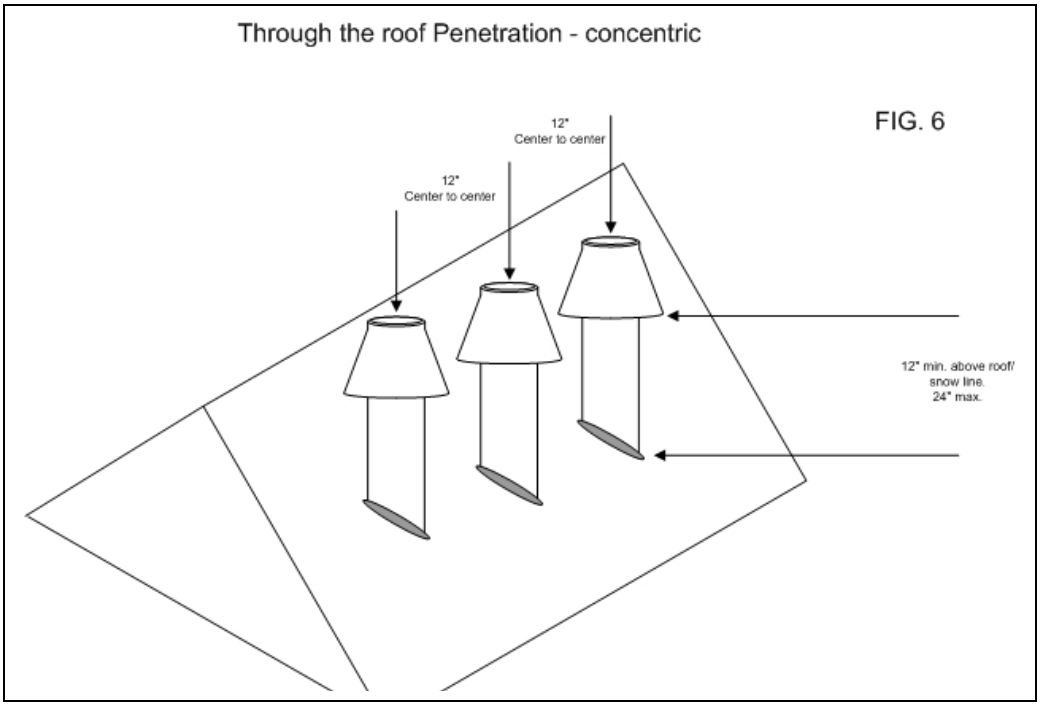
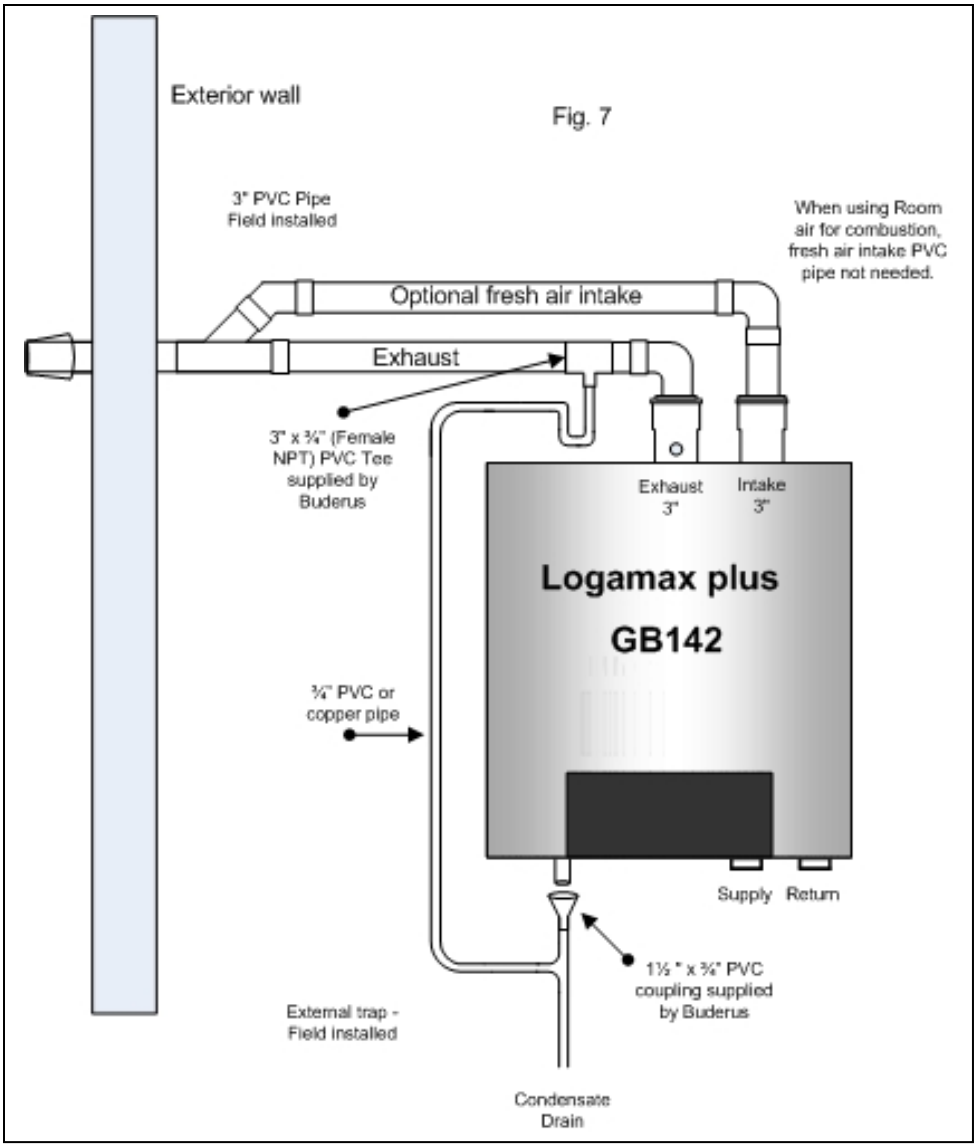


Fig. 5
PVC pipe must be support every five feet on horizontal or vertical runs. Pipe must slope toward boiler (minimum of ¼" per foot).
Bracing supplied by installer. Do not screw or drill into any part of termination or PVC pipe.
Logamax plus
GB142


Through the roof Penetration - concentric
FIG. 6
12" Center to center
12" Center to center
12" min. above roof/ snow line. 24" max.

## SIDE-WALL PENETRATION (CONCENTRIC)

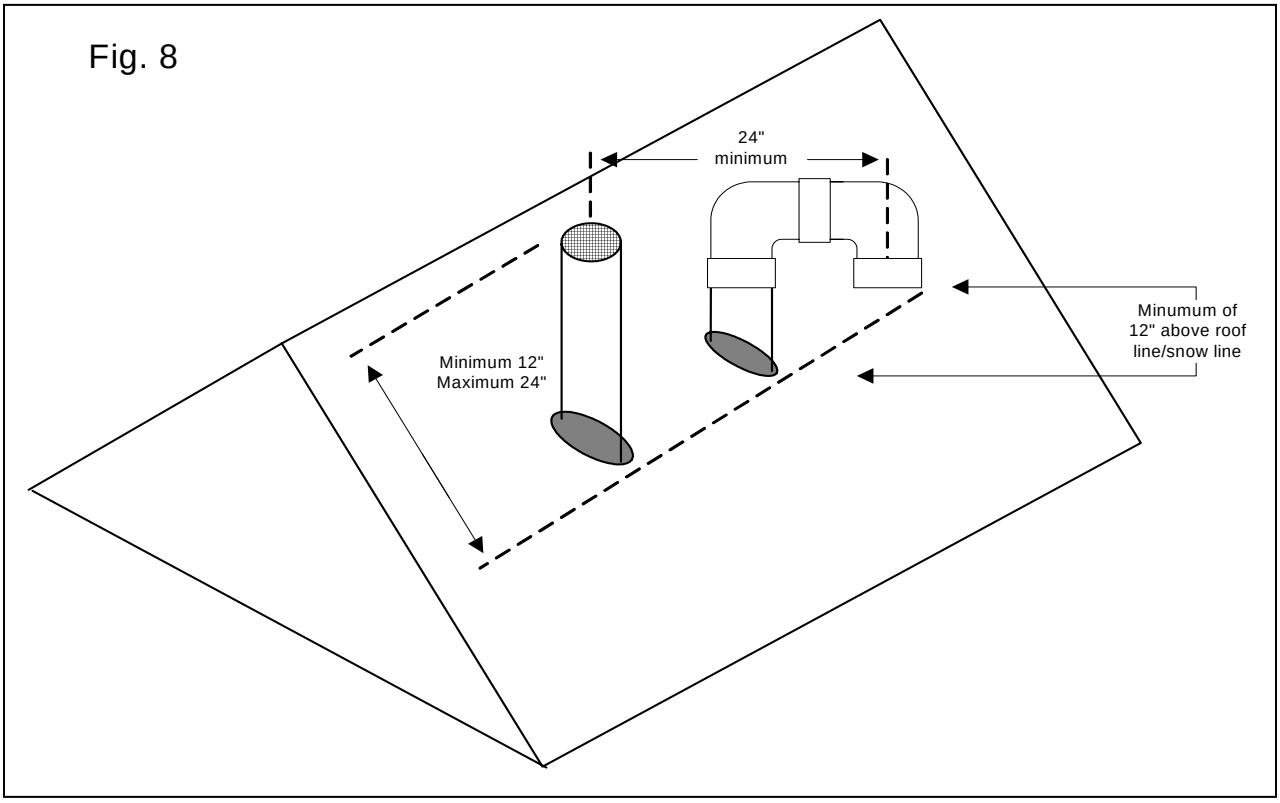
1. Determine best location for vent/air termination using previous guidelines (**FIG. 3A & 7**).
2. Cut a 5" hole to accommodate the 4½" diameter PVC pipe.
3. Cement termination concentric Y to 4½" diameter PVC pipe, then pass through wall penetration and field supplied flashing if required.
4. Insert smaller 2½" PVC vent exhaust pipe into larger 4½" diameter combustion air pipe ensuring PVC exhaust vent pipe is properly cement into concentric Y.
5. Cement vent exhaust pipe and air inlet pipe onto concentric vent termination.
6. Concentric vent termination cannot be extended beyond manufactured length.
7. Concentric vent termination may be cut to desired length.
8. Operate heater through one complete cycle and check for flue gas leakage.
9. Allow 8" center to center horizontal distance between concentric vent terminations with multiple heater installations.



## THROUGH THE ROOF PENETRATION (NON-CONCENTRIC)

1. Determine best location for vent/air termination using previous guidelines.
2. Air pipe penetration – Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
3. Vent pipe penetration – Cut a hole for the vent pipe. Size the vent pipe hole as close as desired to the vent pipe outside diameter.
4. Space the air and vent holes to provide the minimum spacing (see **FIG. 8**).
5. Follow all local codes for isolation of vent pipe when passing through floors, ceilings and roofs.
6. Install a field supplied roof penetration boot/flashing.

Fig. 8



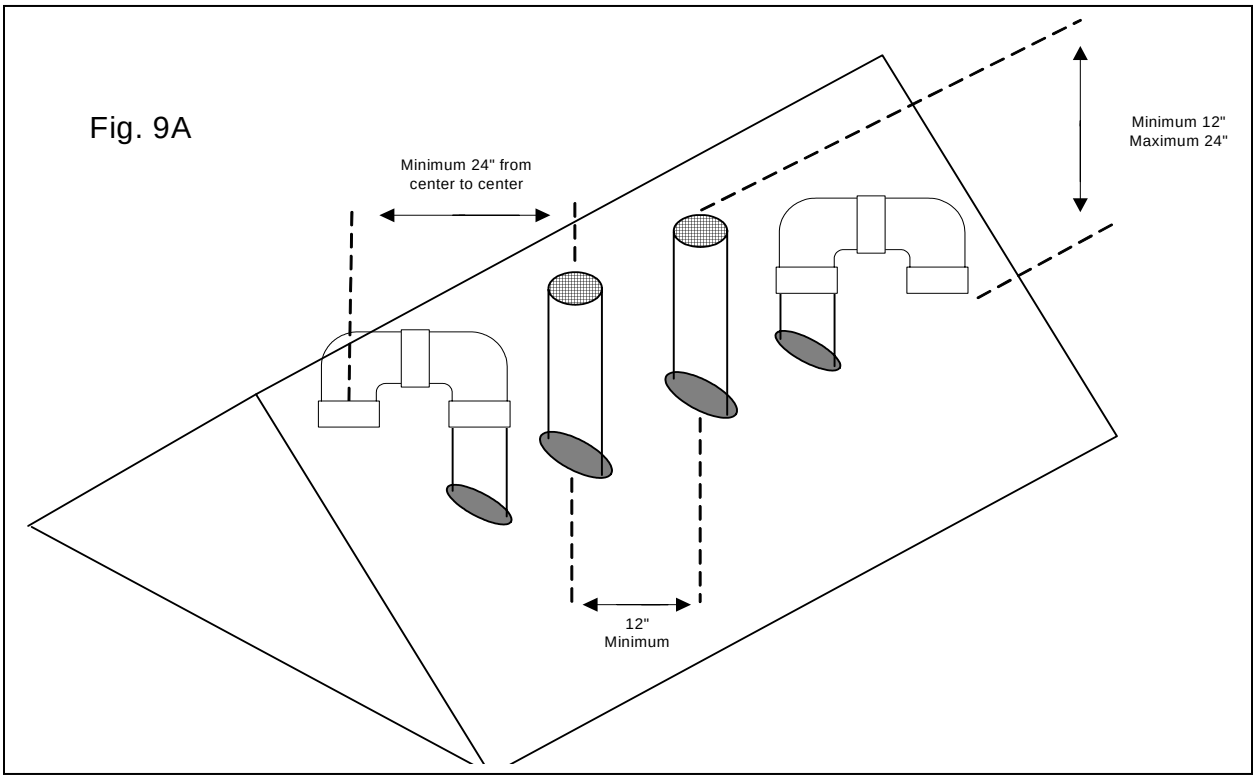
## TERMINATION AND FITTING

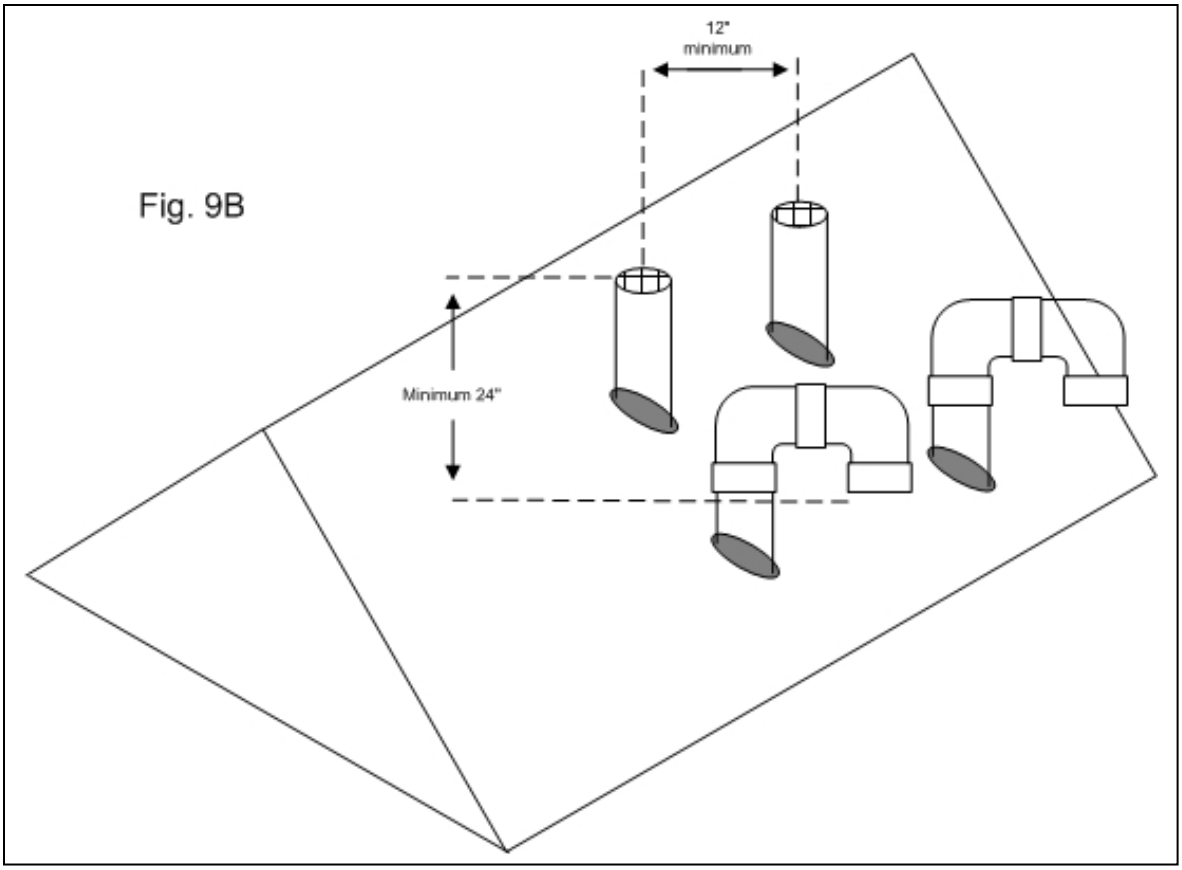
1. Prepare the vent termination coupling and the air termination elbow by inserting the bird screens provided with boiler into the three inch fittings.
2. The combustion air inlet shall terminate at least 12 inches above maximum snow line or 24 inches above roof surface which ever is greater.
3. The combustion air inlet pipe must terminate in a downward position using two 90 degree elbows. The combustion air inlet pipe shall terminate at least two feet horizontally from the center line of the exhaust vent, this is to prevent cross contamination of flue gases into the combustion air stream.
4. The exhaust vent must terminate vertically upward with a coupling and bird screen. The top of the coupling shall termination at least 12 inches above the bottom of the down-turned 90° elbow, but no more than 24 inches.

## MULTIPLE HEATER INSTALLATION

Terminate all exhaust vents at the same height and all combustion air inlets at the same height, while maintaining the minimum 12" to a maximum of 24" height clearance from the exhaust to the down turned 90 degree elbow and combustion air inlet. Exhaust vent termination edge shall be at least 12" from the edge of the air inlet pipe of an adjacent heater. Exhaust vent terminations may be place next to each other as practical, like wise air intake terminations may also be placed next to each other. The combustion air inlet is part of the direct vent system and not classified as a forced air inlet (see **FIG. 9A** and **9B**).

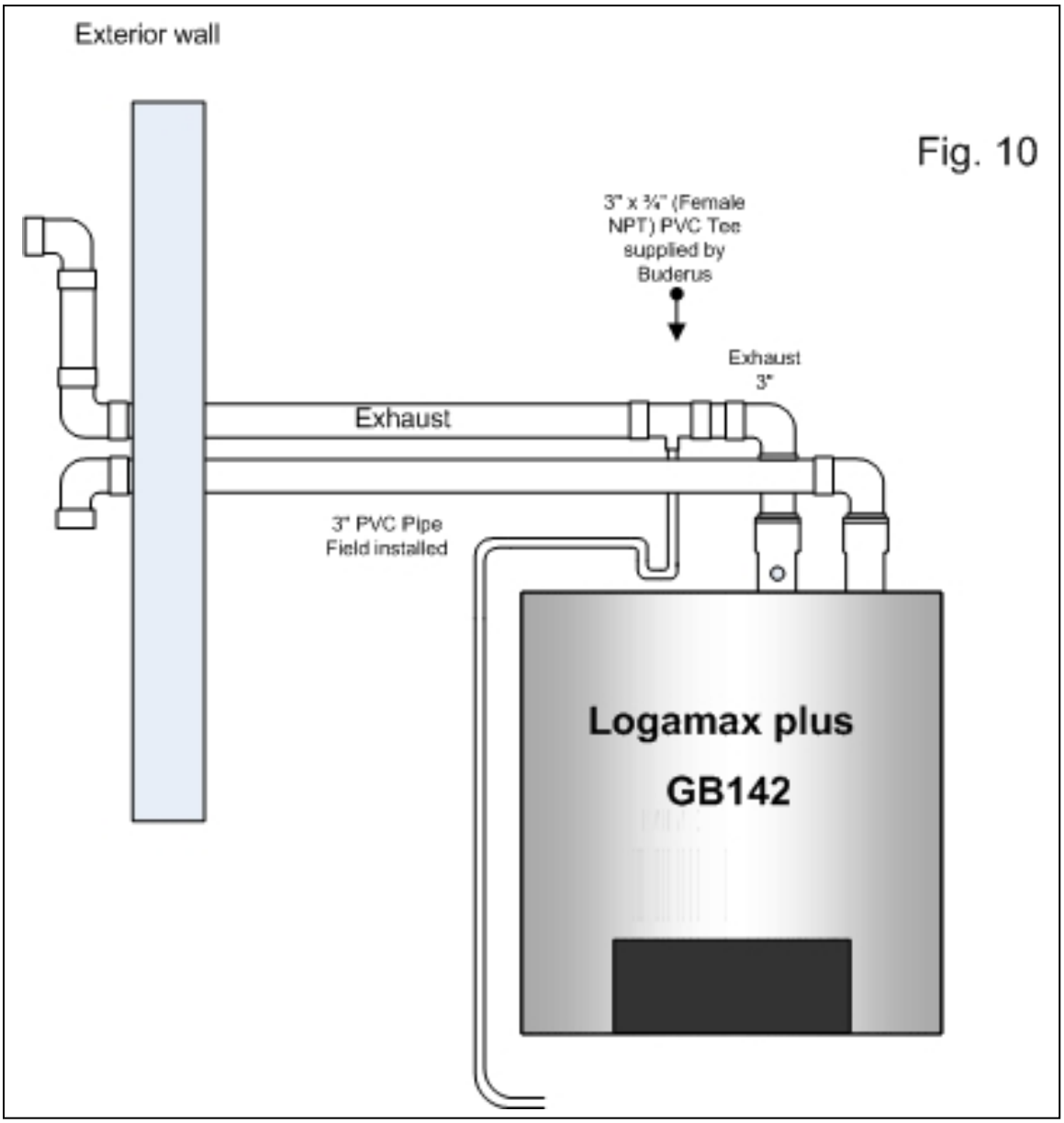
Fig. 9A






## SIDE-WALL PENETRATION (NON-CONCENTRIC)

1. Determine best location for vent/air termination using previous guidelines.
2. Cut a 4" hole to accommodate the 3½" diameter PVC pipe. Through the wall penetration may be sealed with a field provided flashing if required.
3. Insert bird screens provided with heater into both exhaust and combustion air (field supplied) elbows.
4. Combustion air inlet elbow should always be positioned downward.
5. The exhaust outlet or elbow shall always be positioned pointing away from the building.
6. Combustion air inlet elbow must terminate at least 12" below exhaust elbow or outlet, but not exceed 15" maximum separation.
7. Combustion air inlet must maintain at least 12" above grade and/or snow line.
8. Combustion air inlet may be extended vertically upward a maximum of 24" from the building penetration (see **FIG. 10**).
9. Do not extend exposed exhaust vent pipe outside the building beyond recommendations.
10. Horizontal termination shall not extend beyond 18 inches from the building (based on minimum 12 inch required separation between intake and exhaust). Exhaust vent vertical rise shall not extend beyond 39" from building penetration to termination elbow. Condensate could freeze and block vent pipe.
11. Operate heater through one complete cycle and check for flue gas leakage.




**Multiple Heater installation** – Terminate all exhaust vents at the same height and all combustion air inlets at the same height, while maintaining the minimum 12 inches vertical height clearance from between exhaust and combustion air inlet. Exhaust vent termination edge shall be at least 12 inches laterally from the edge of the air inlet pipe of an adjacent heater. The combustion air inlet is part of the direct vent system and not classified as a forced air inlet.

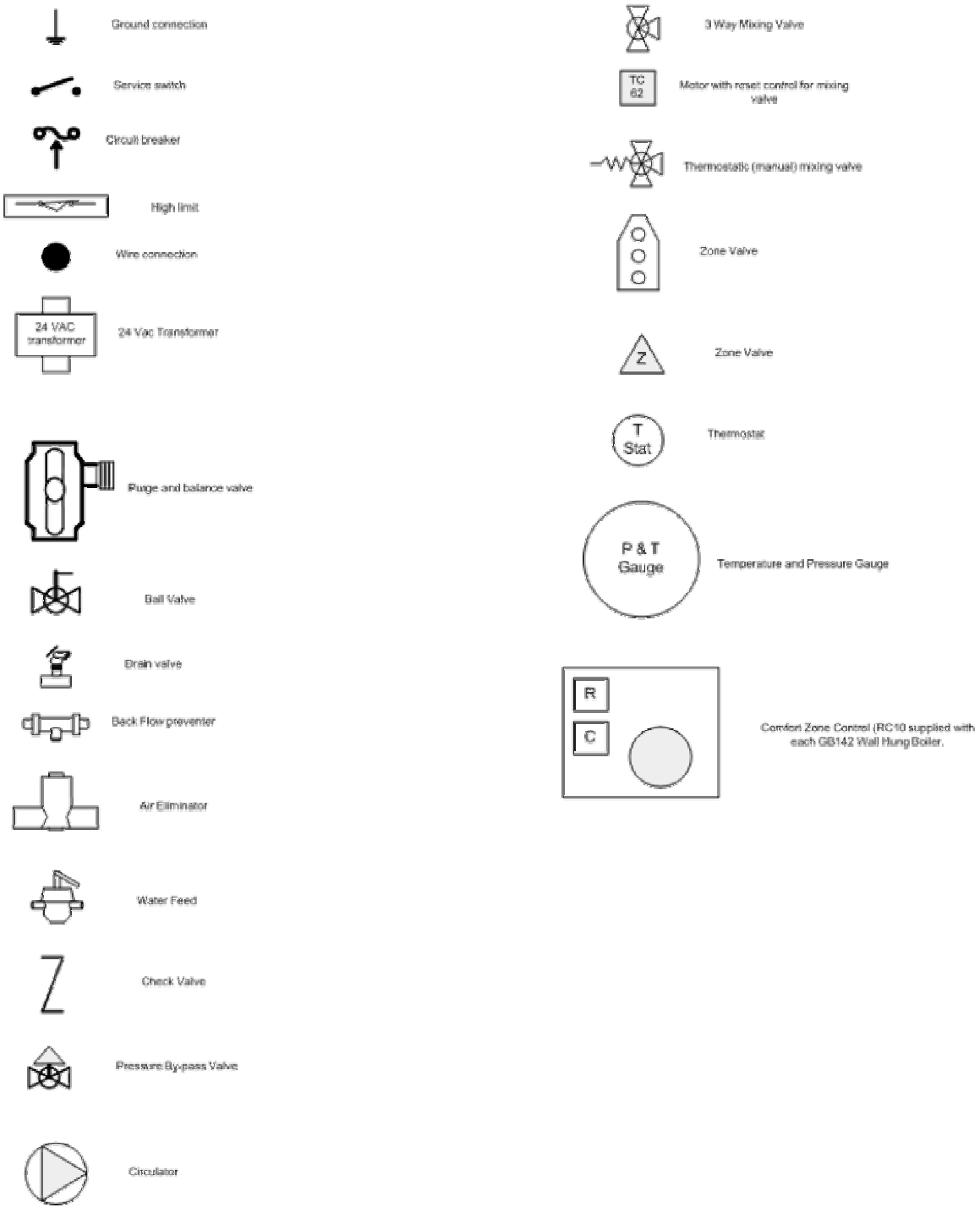
## CONDENSATE PIPING

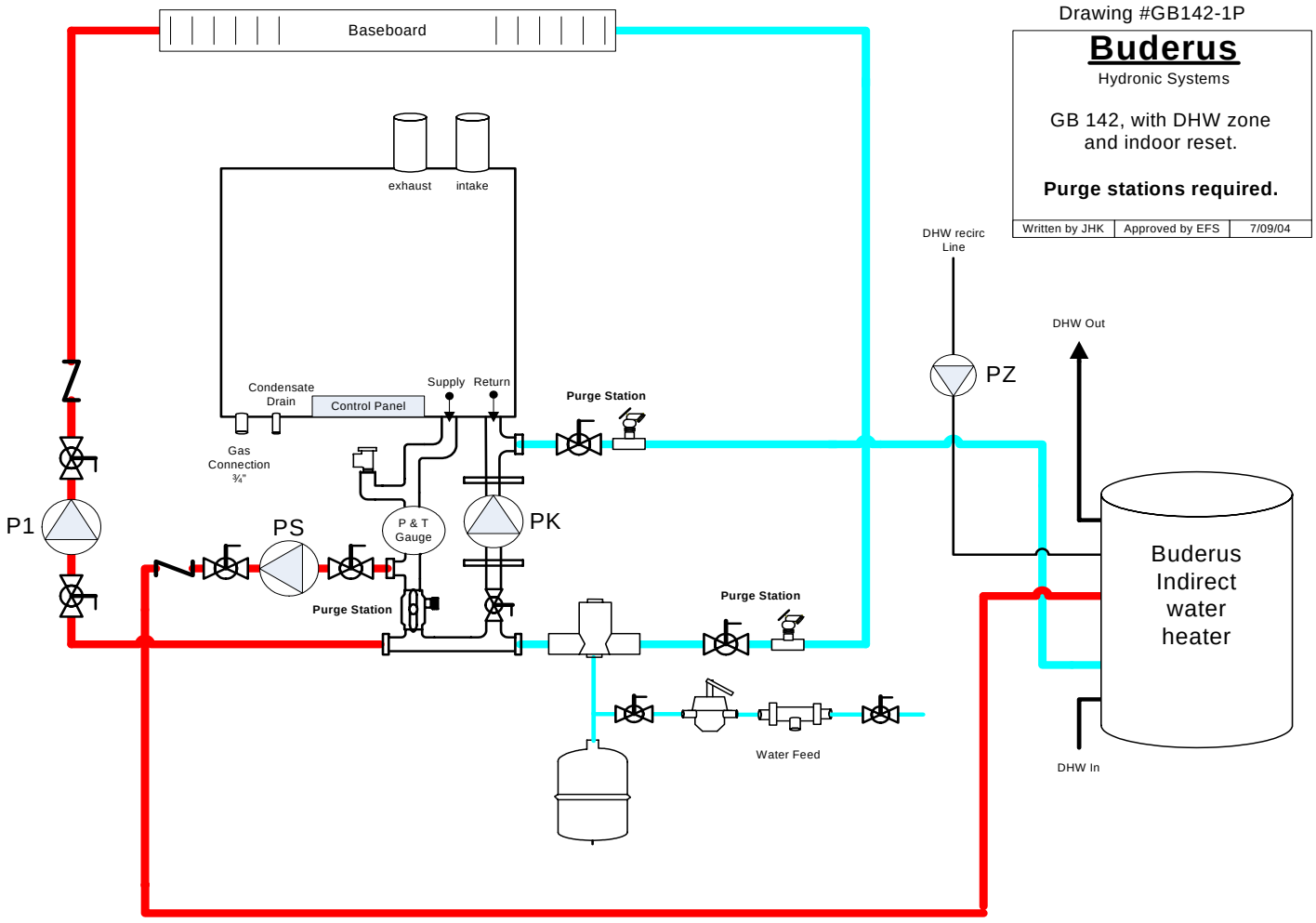
Figure 10 shows a typical sealed combustion installation.

- The furnished 3" x ¾" socket female vent condensate drain must be installed as close as possible to the exhaust connection with the ¾" branch pointing down to drain condensate.
- Install furnished 1-1/2" x ¾" coupling under GB142 condensate drain, install a ¾" PVV tee and bring in upper vent drain with a trap into this tee.
- Pour 1 qt. of water in exhaust pipe and make sure to fill the external trap and internal trap of the GB142.
- In case of vertical venting, install a short horizontal run to install the vent condensate drain.

# 5 DRAWINGS

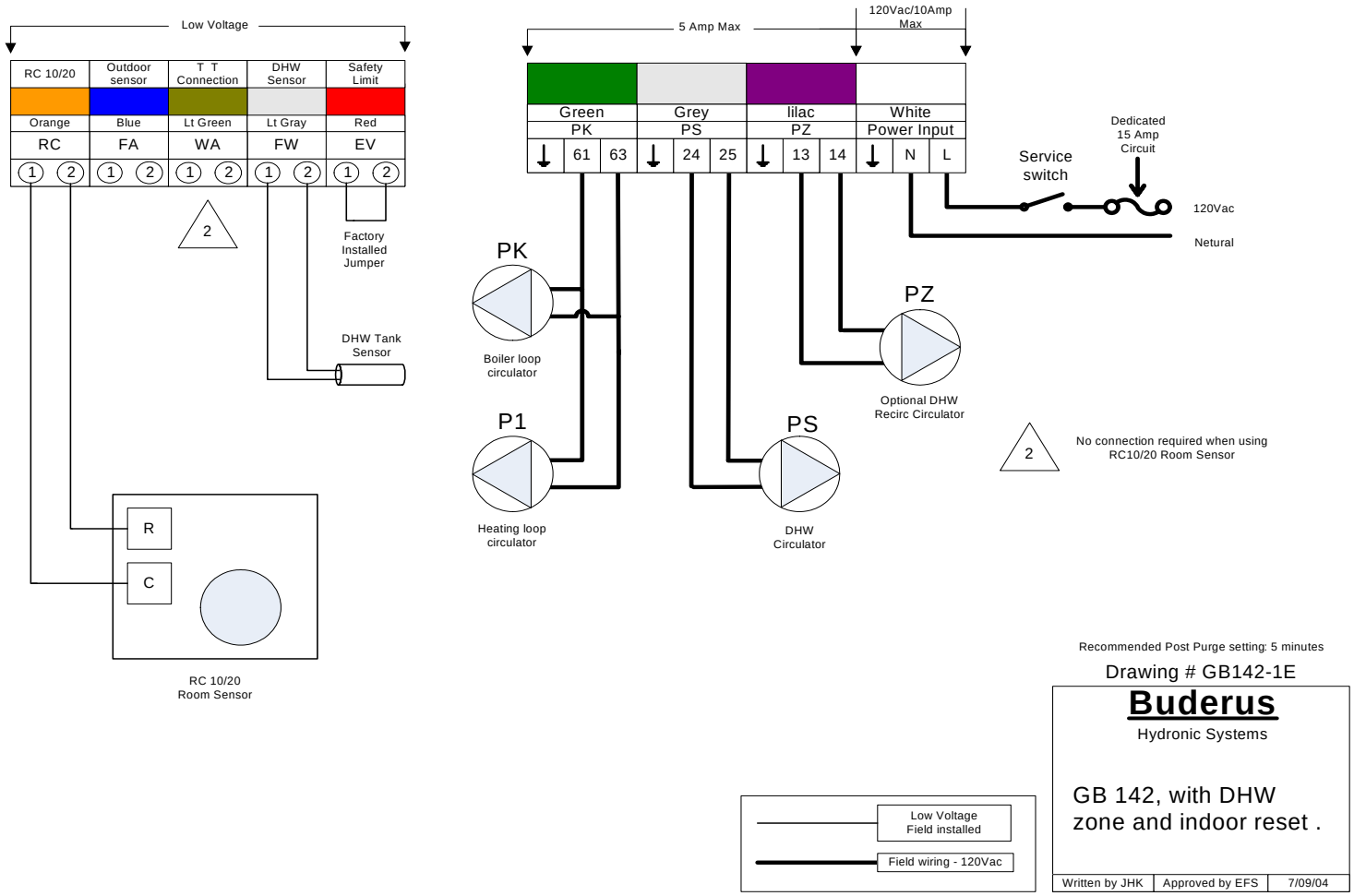
## Mechanical/Electrical Symbols






**Note:** This drawing is conceptual in nature and does not purport to address all design, installation or safety considerations. Additional safety and/or auxiliary equipment may be needed. This diagram is for reference use by officials, designers and licensed installers. It is expected that installers have adequate knowledge of accepted industry practices for the equipment, procedures, and applications involved.

**Drawing is not to scale.**




Recommended Post Purge setting: 5 minutes

Drawing # GB142-1E

**Buderus**

Hydronic Systems

GB 142, with DHW zone and indoor reset .

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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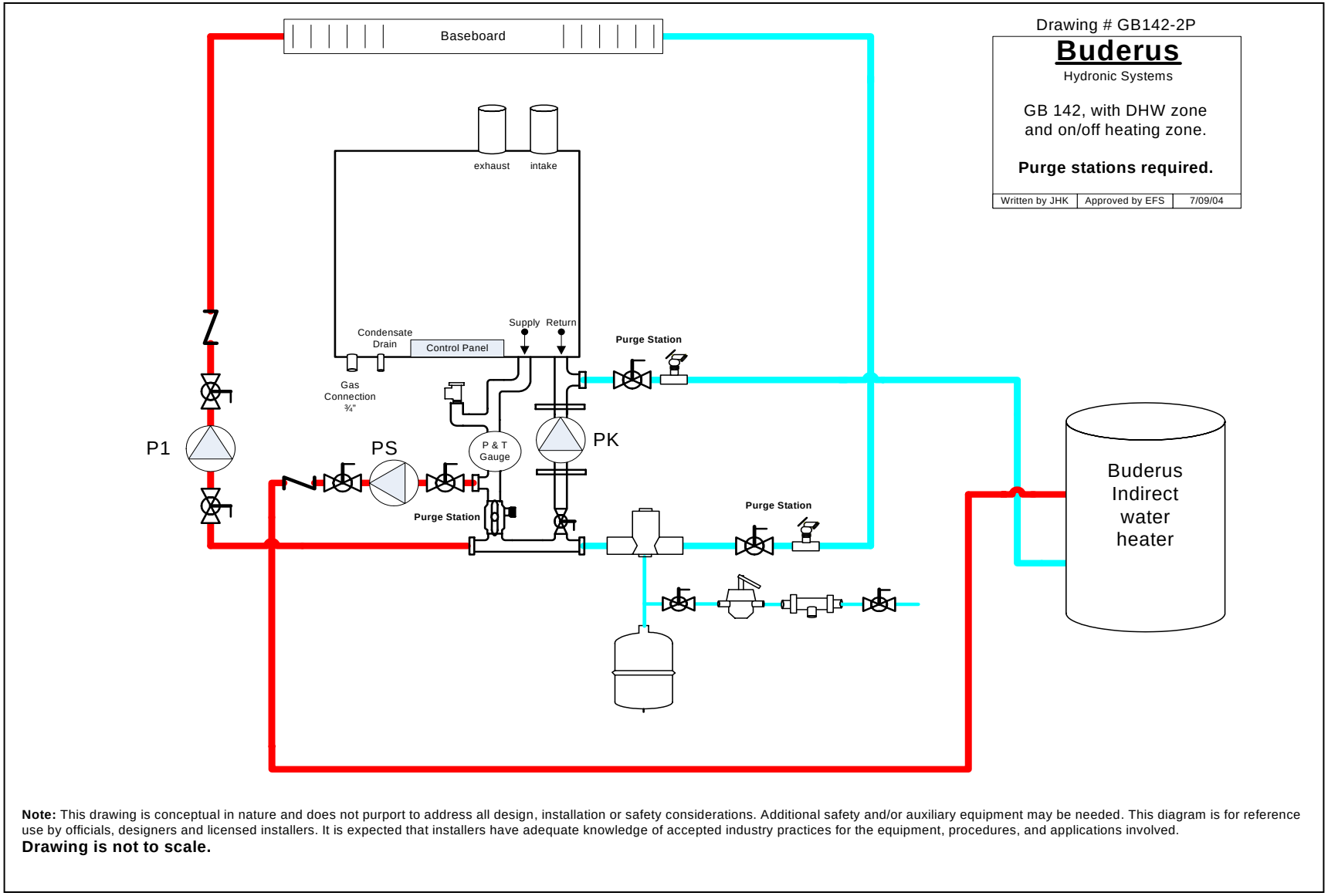


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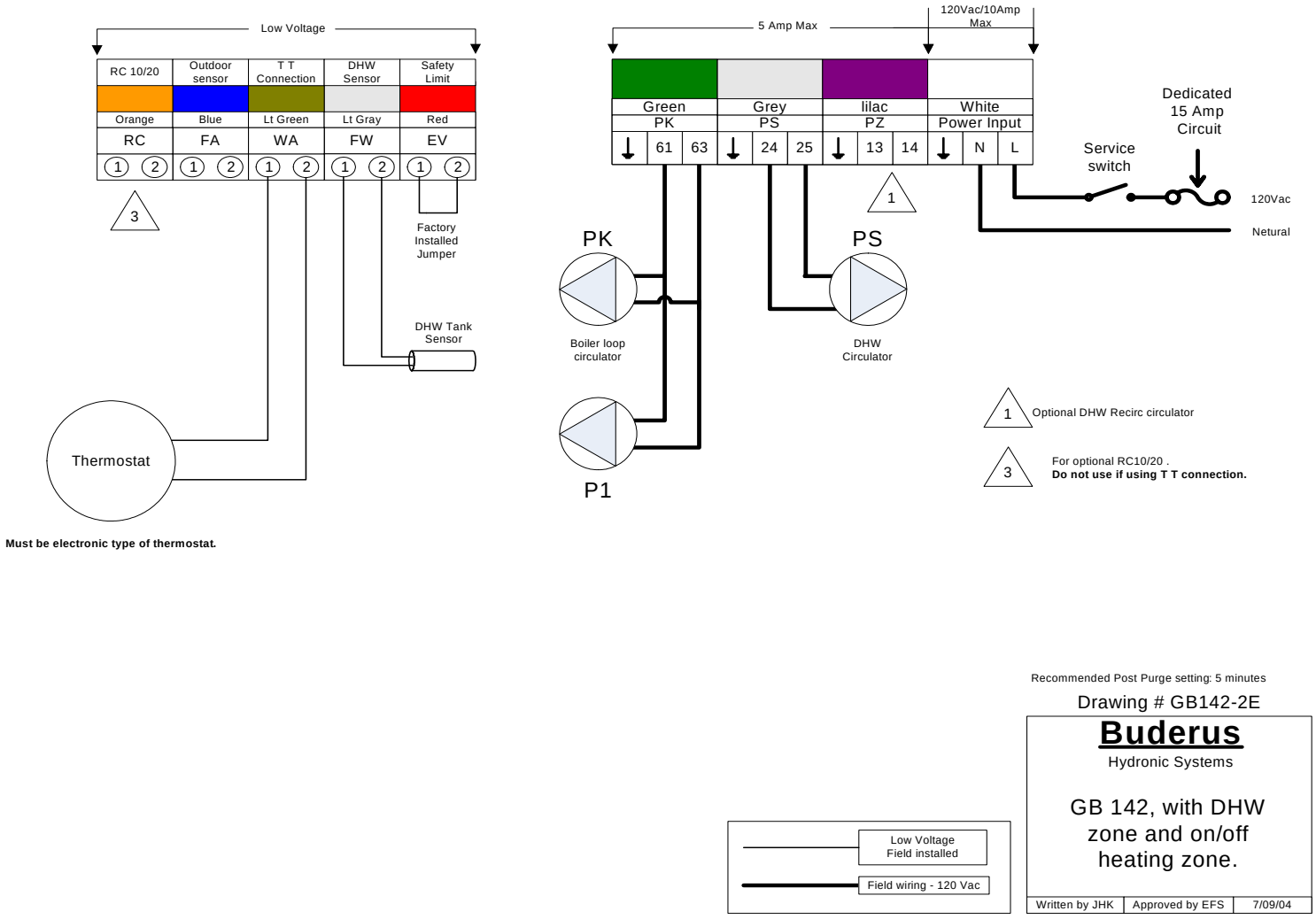


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**Drawing is not to scale.**

Drawing #GB142-3P

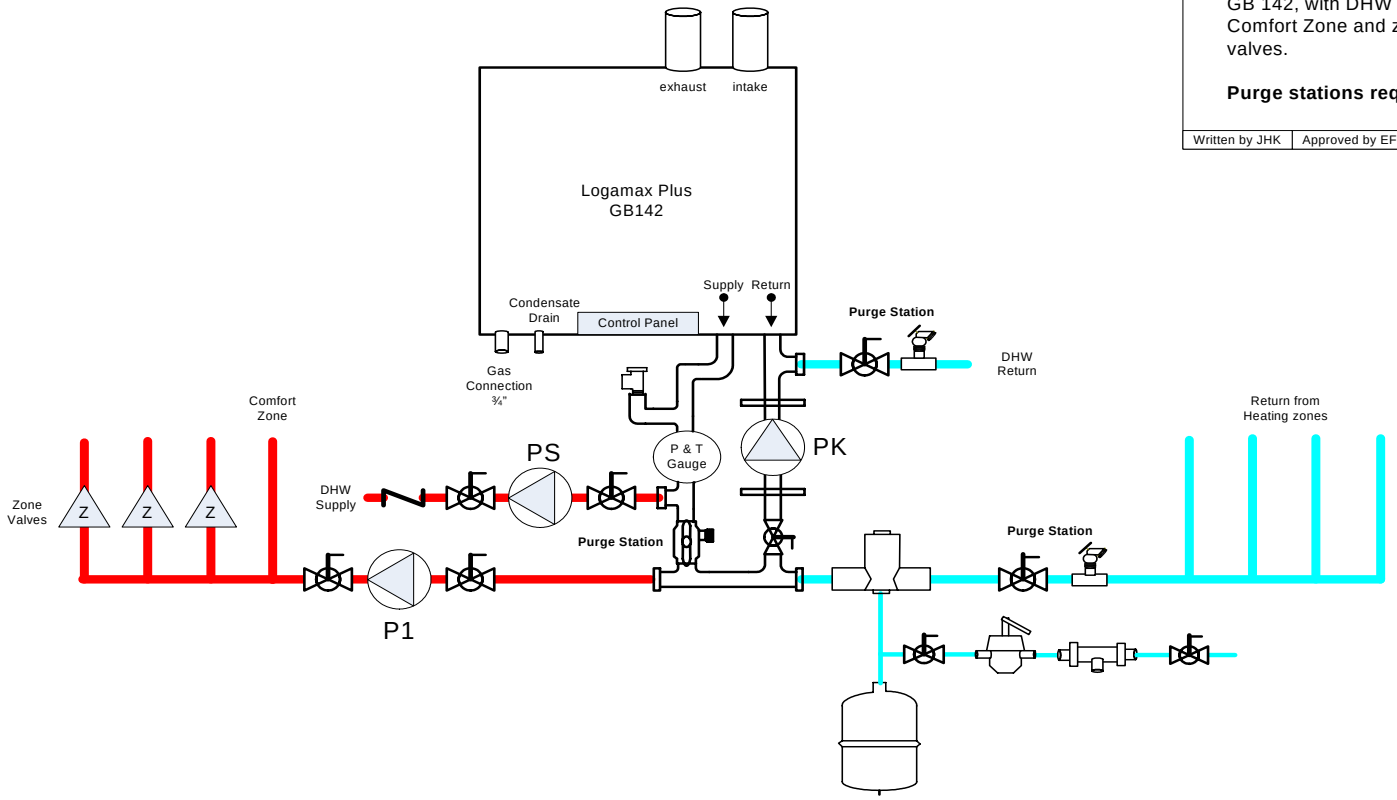
**Buderus**

Hydronic Systems

GB 142, with DHW zone, Comfort Zone and zone valves.

**Purge stations required**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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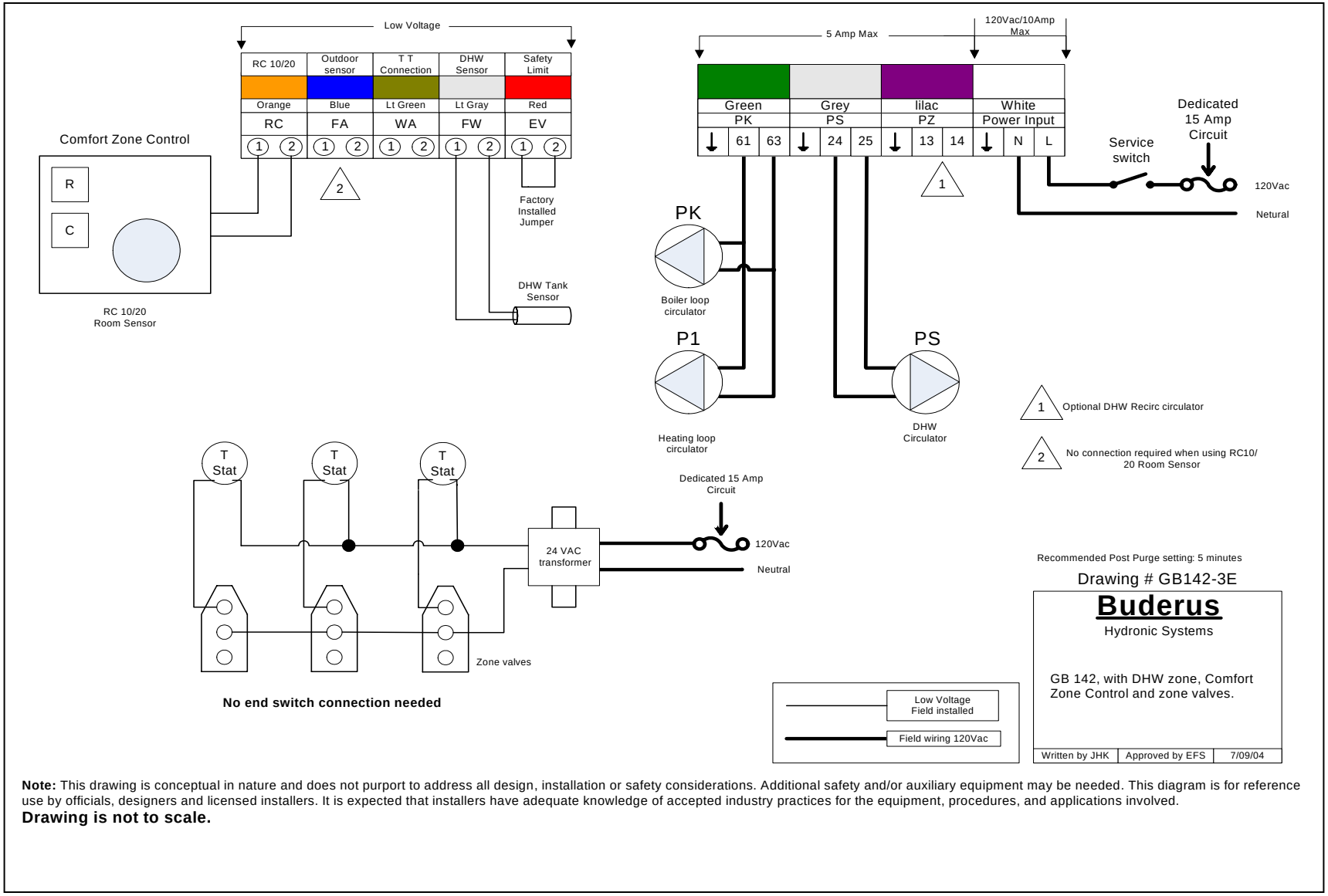
**Drawing is not to scale.**

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**Drawing is not to scale.**

Drawing #GB142-4P

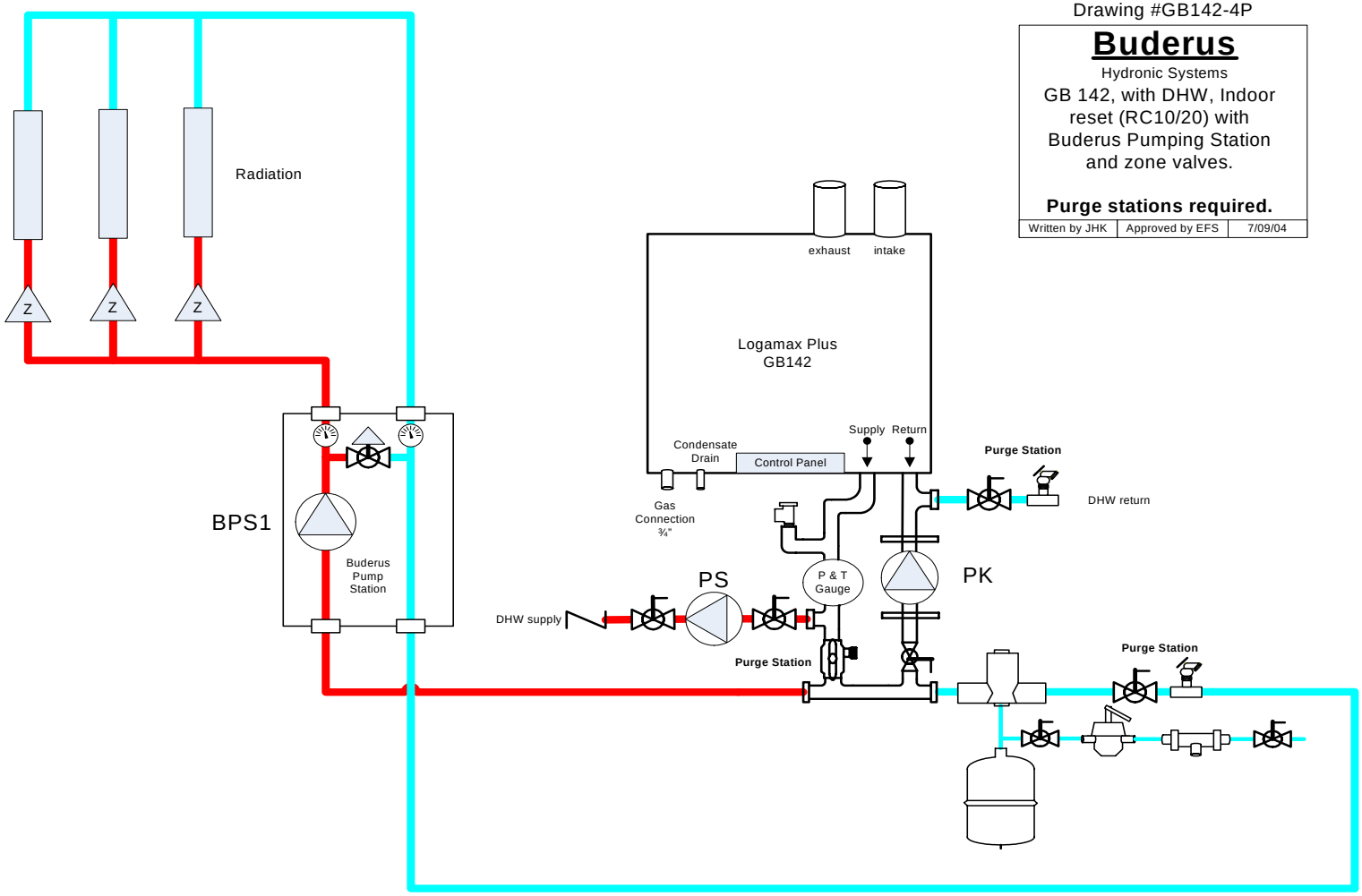
**Buderus**

Hydronic Systems

GB 142, with DHW, Indoor reset (RC10/20) with Buderus Pumping Station and zone valves.

**Purge stations required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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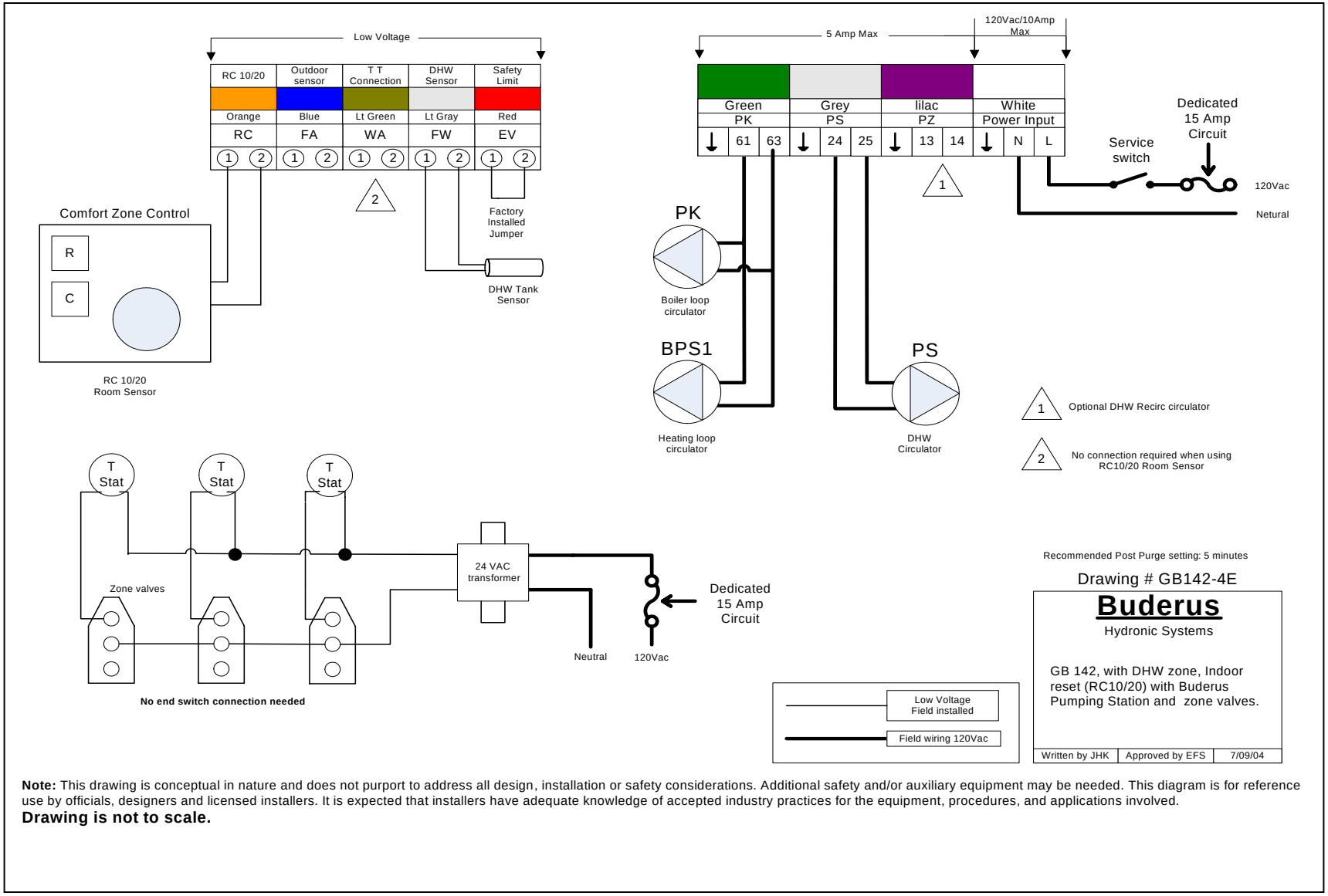
**Drawing is not to scale.**

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**Drawing is not to scale.**

Drawing # GB142-5P

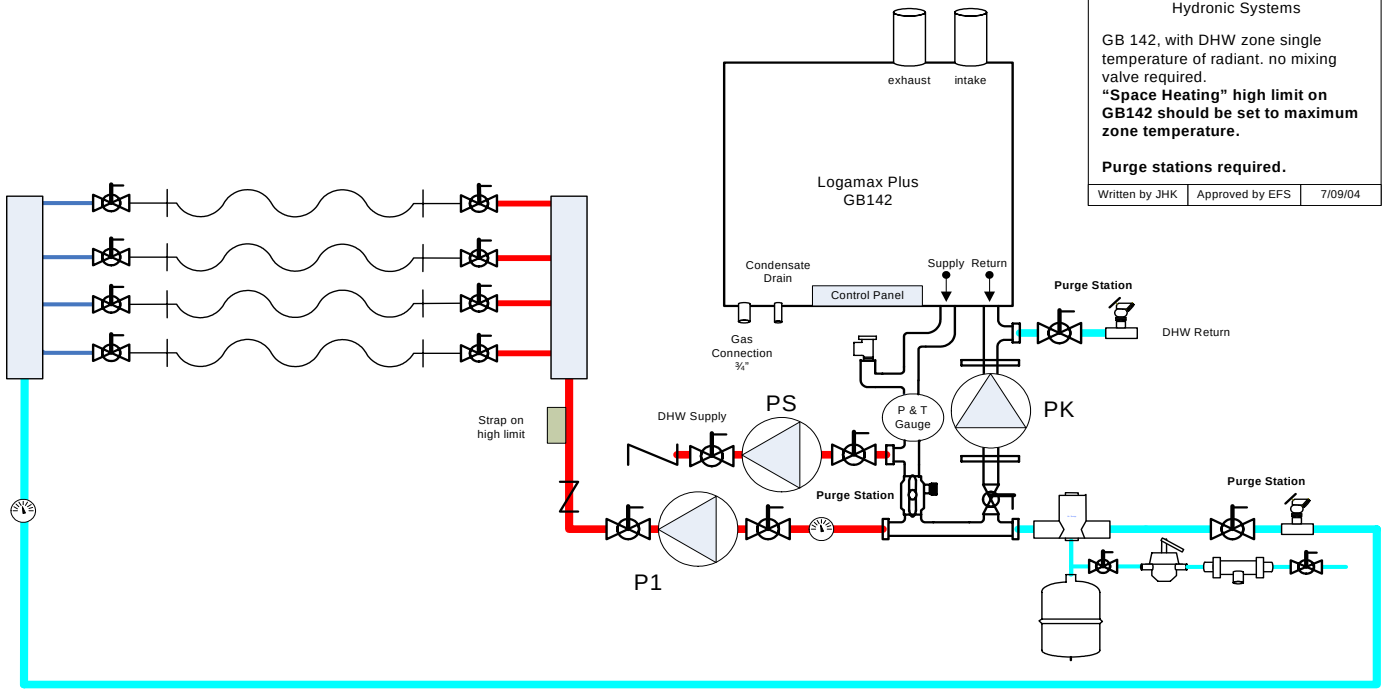
**Buderus**

Hydronic Systems

GB 142, with DHW zone single temperature of radiant. no mixing valve required.
**"Space Heating" high limit on GB142 should be set to maximum zone temperature.**

**Purge stations required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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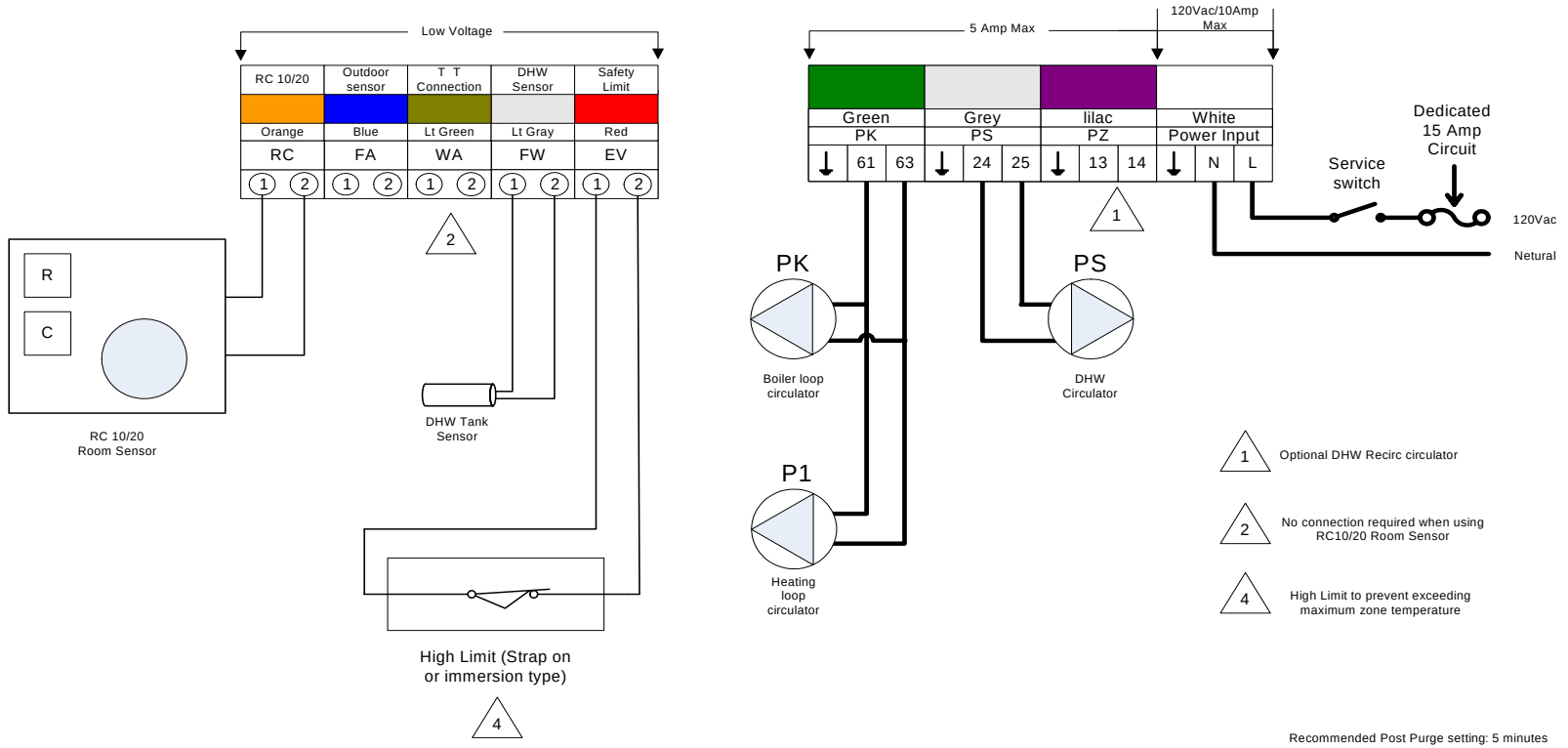
**Drawing is not to scale.**

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**Drawing is not to scale.**

GB Drawing #142-6P

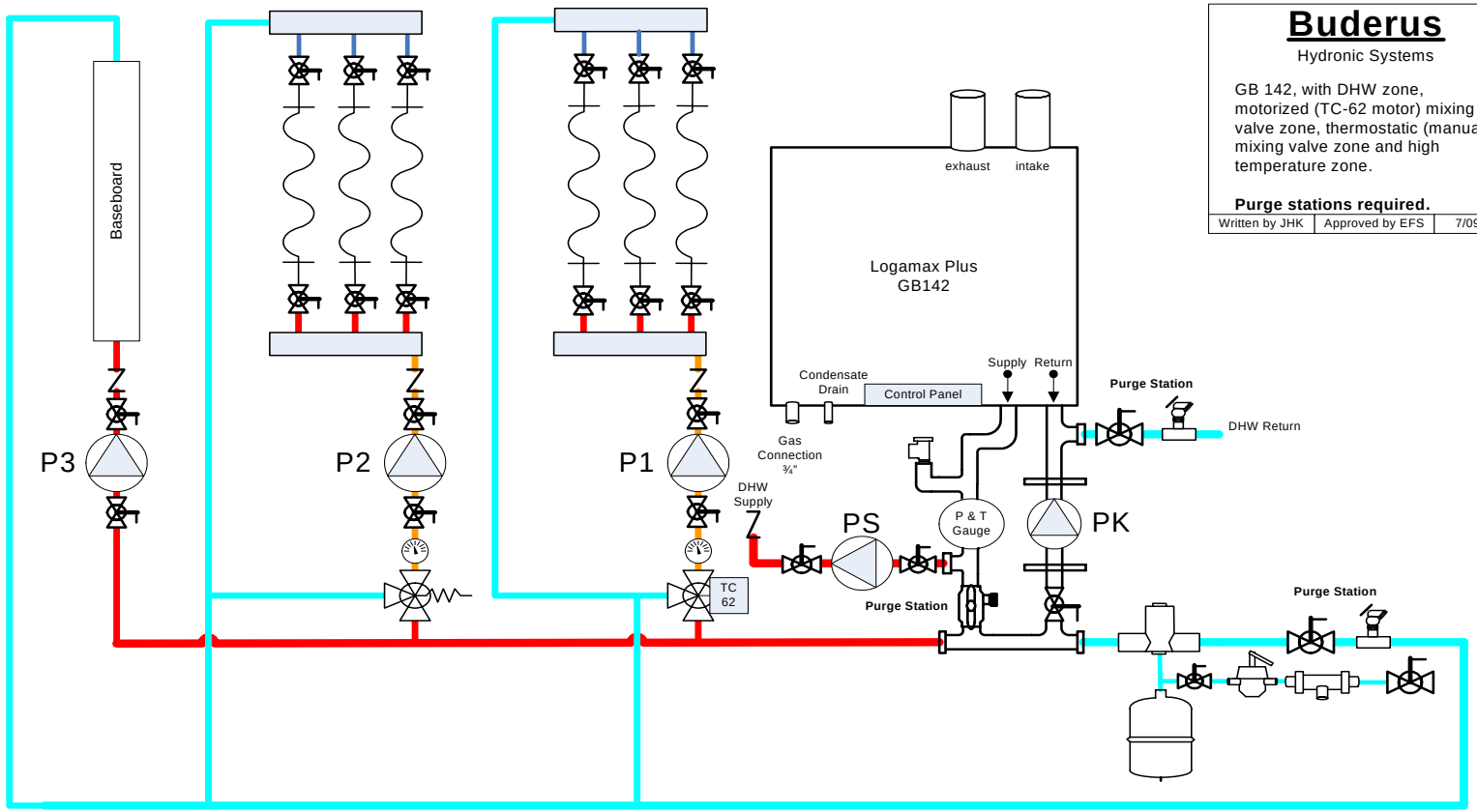
**Buderus**

Hydronic Systems

GB 142, with DHW zone, motorized (TC-62 motor) mixing valve zone, thermostatic (manual) mixing valve zone and high temperature zone.

**Purge stations required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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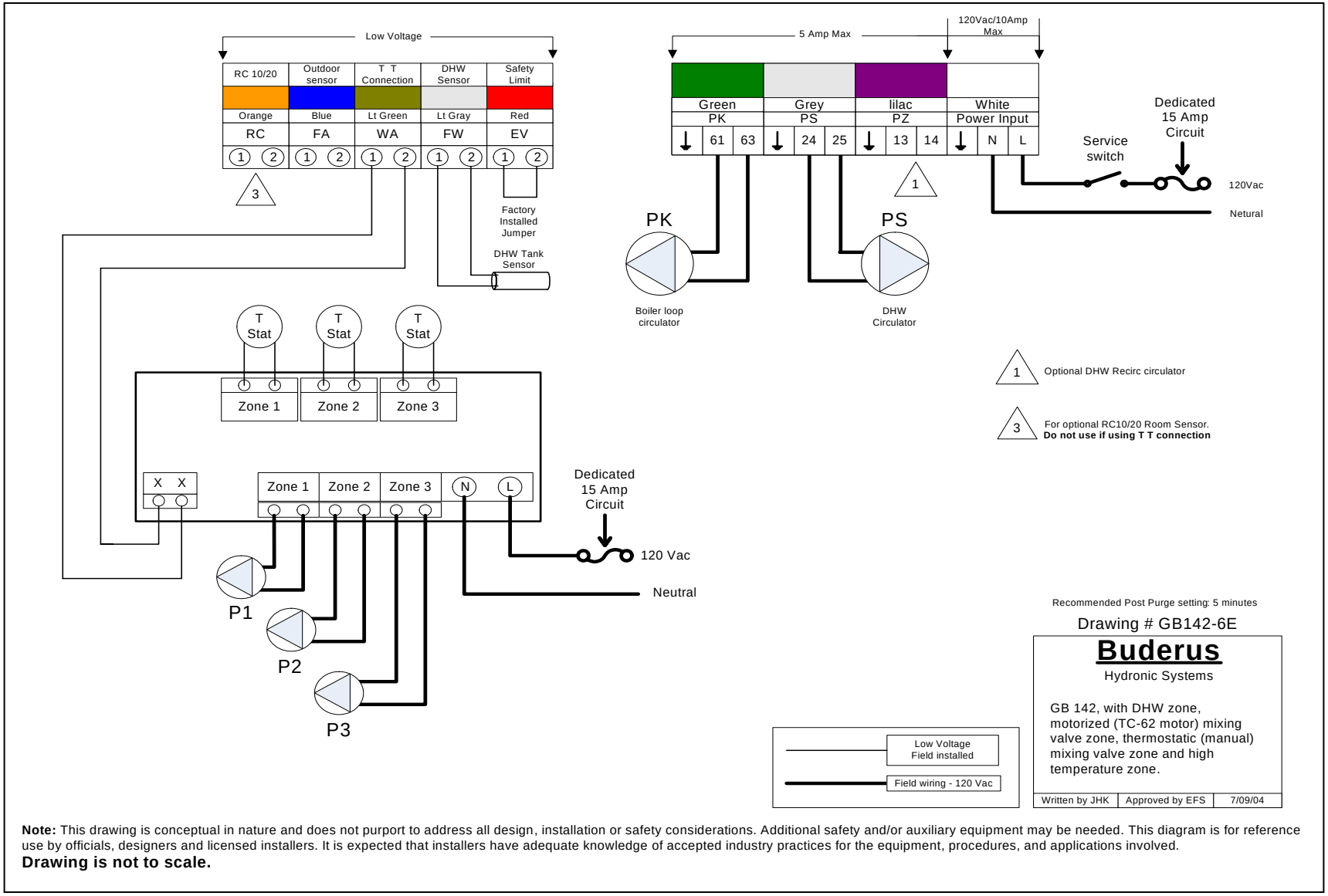
**Drawing is not to scale.**

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**Drawing is not to scale.**

Drawing #GB142-7P

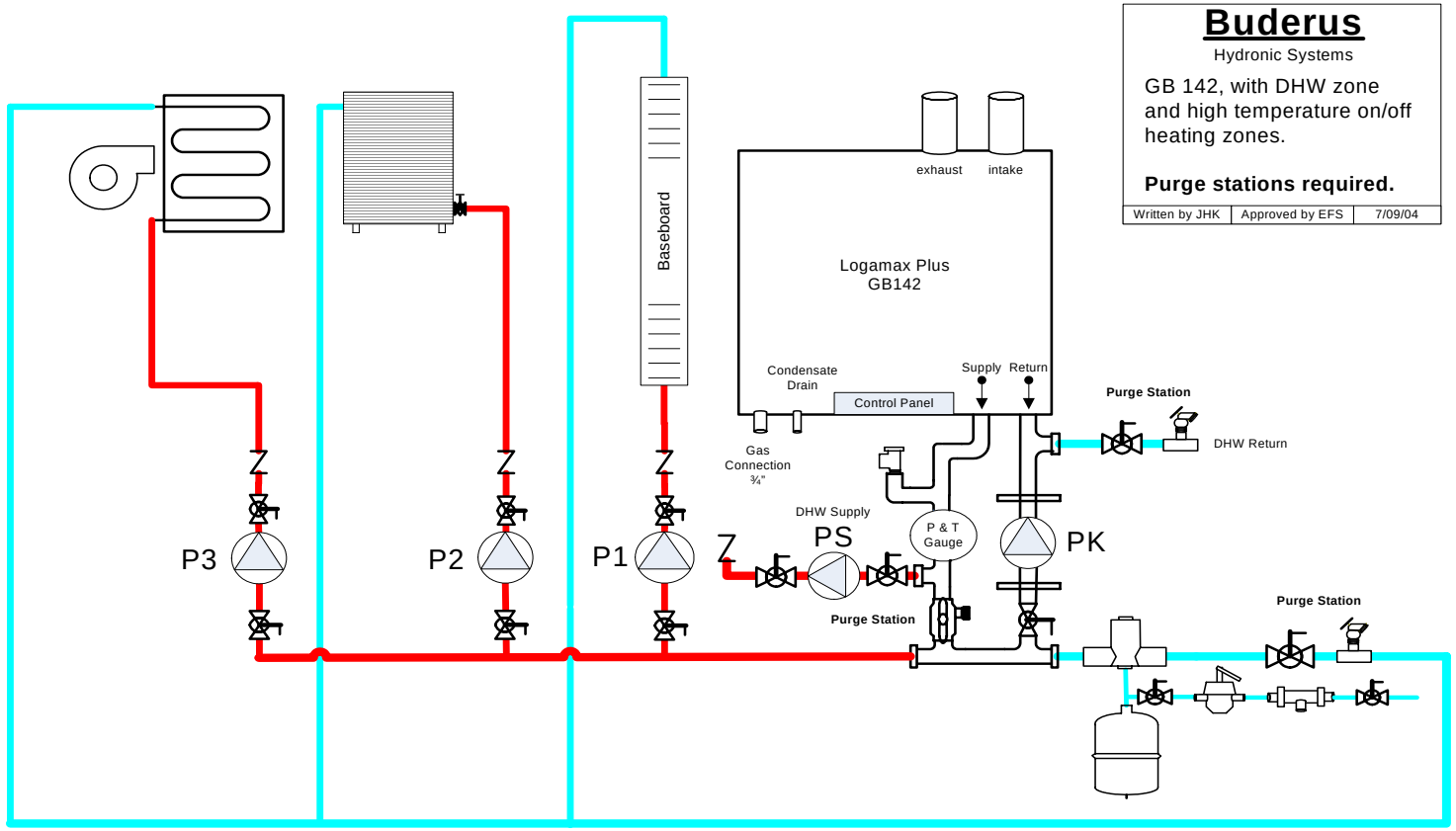
# Buderus

Hydronic Systems

GB 142, with DHW zone and high temperature on/off heating zones.

**Purge stations required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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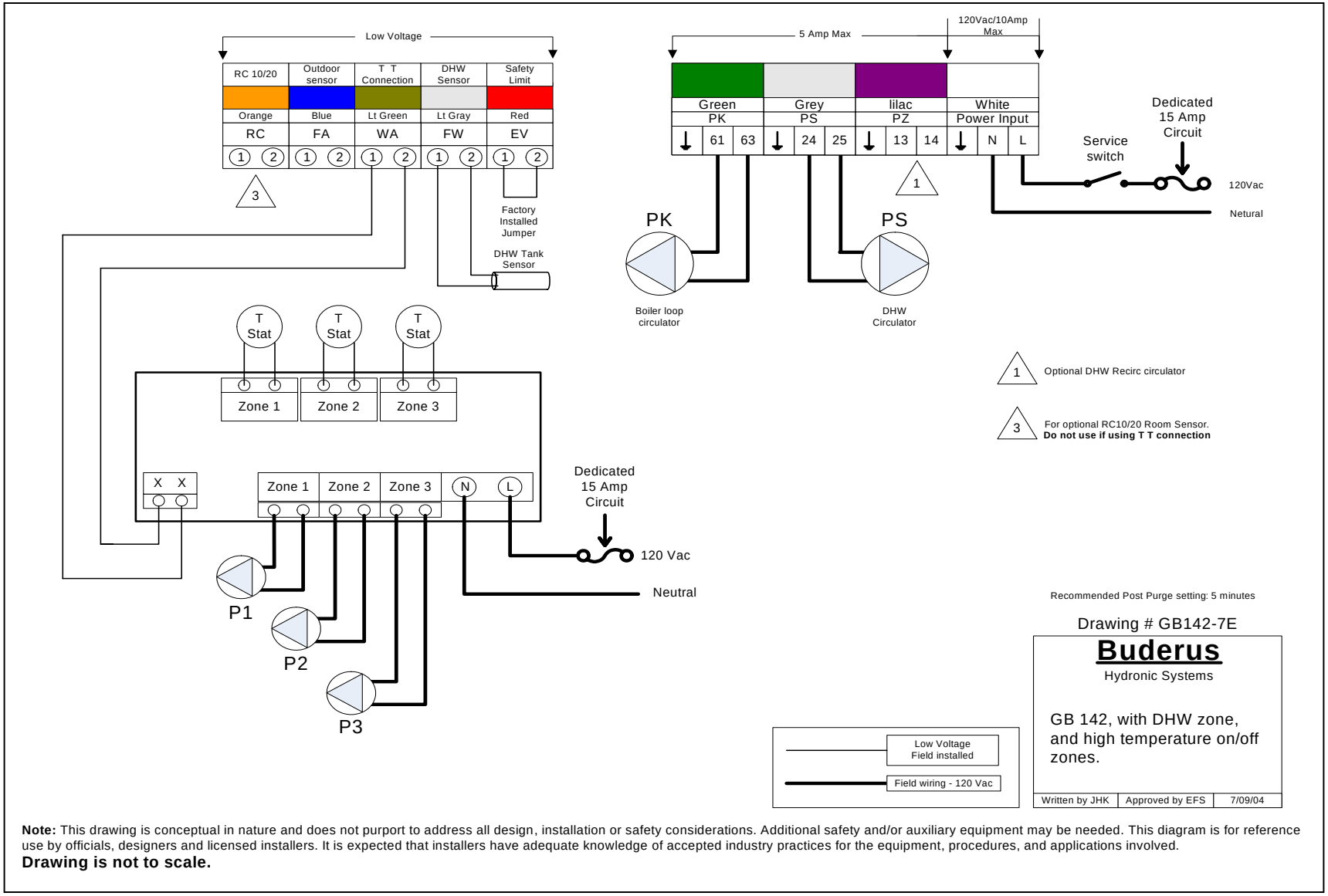


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**Drawing is not to scale.**

Drawing #GB142-8P

**Buderus**

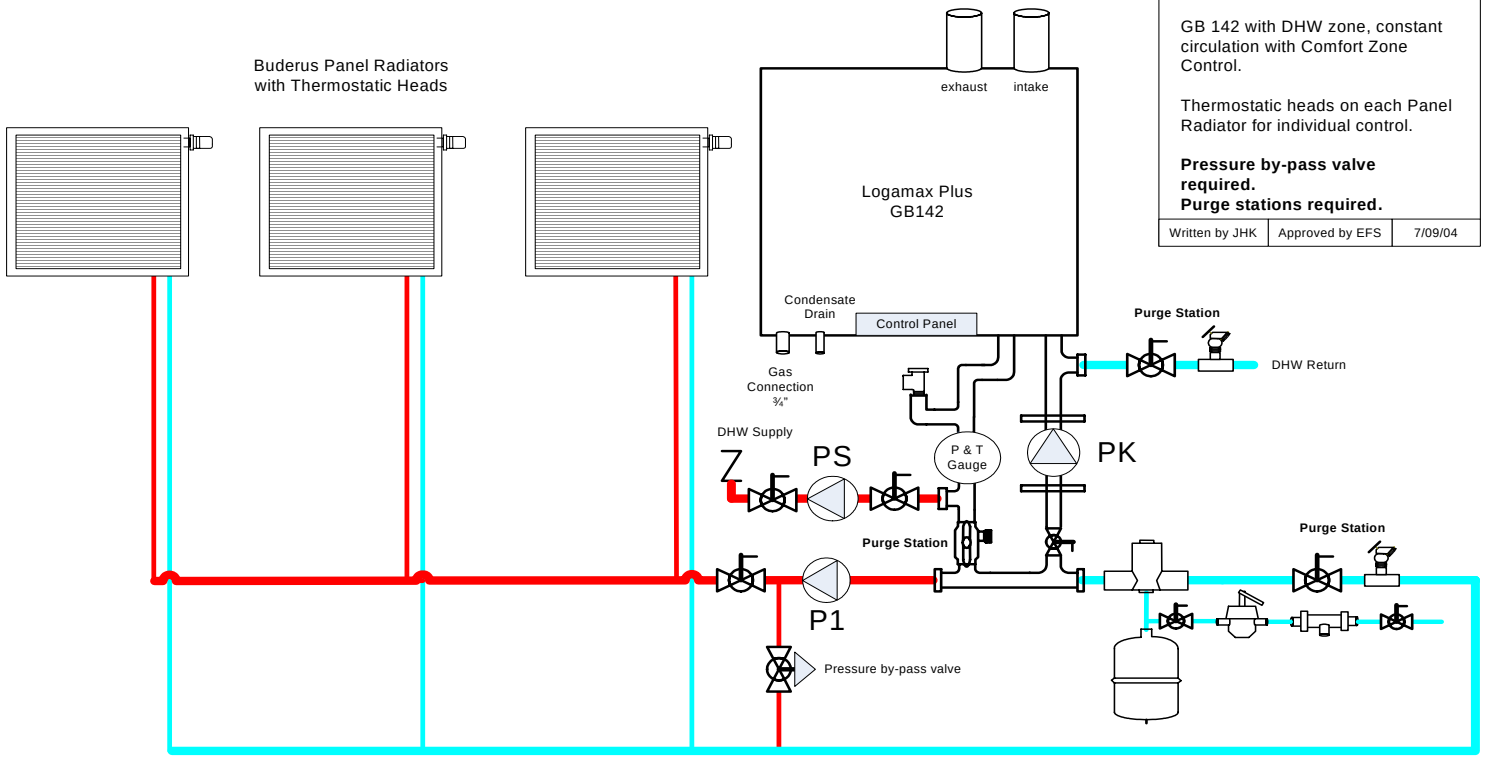
Hydronic Systems

GB 142 with DHW zone, constant circulation with Comfort Zone Control.

Thermostatic heads on each Panel Radiator for individual control.

**Pressure by-pass valve required.**
**Purge stations required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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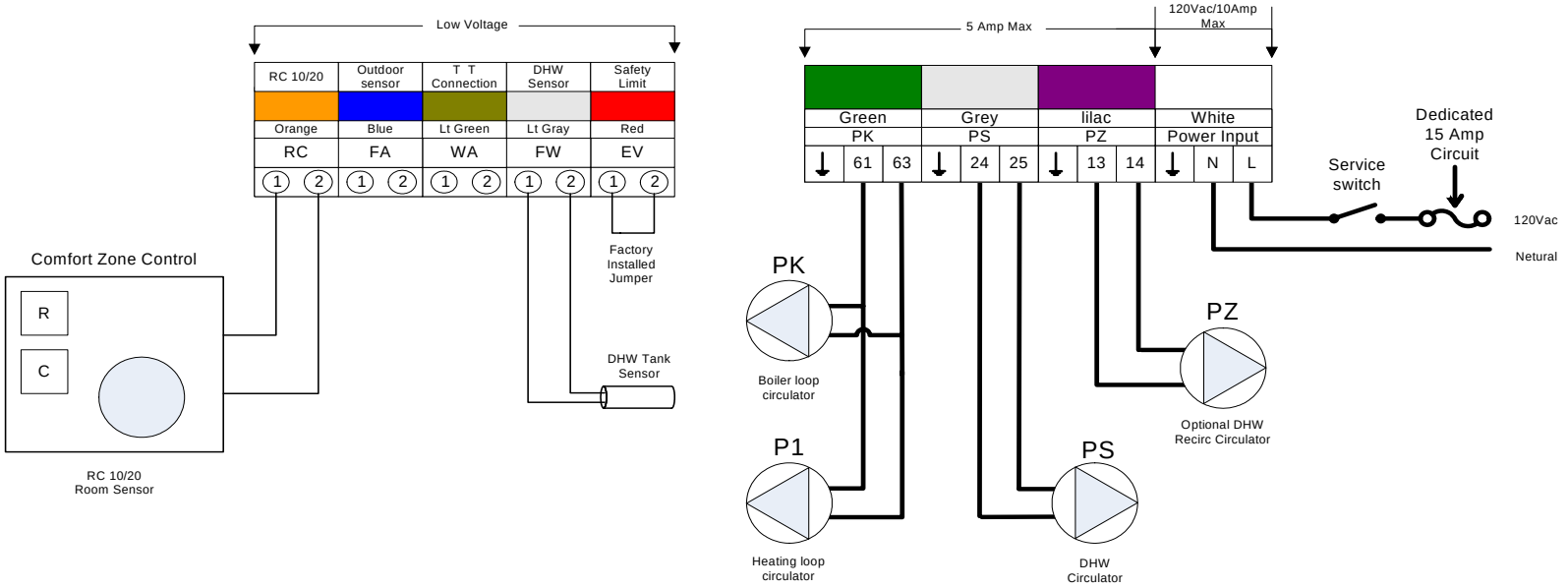


Recommended Post Purge setting: 5 minutes

Drawing # GB142-8E

**Buderus**

Hydronic Systems

GB 142, with DHW zone, constant circulation with Comfort Zone Control.

**Pressure by-pass valve required.**

| Written by JHK | Approved by EFS | 7/09/04 |
|---|---|---|

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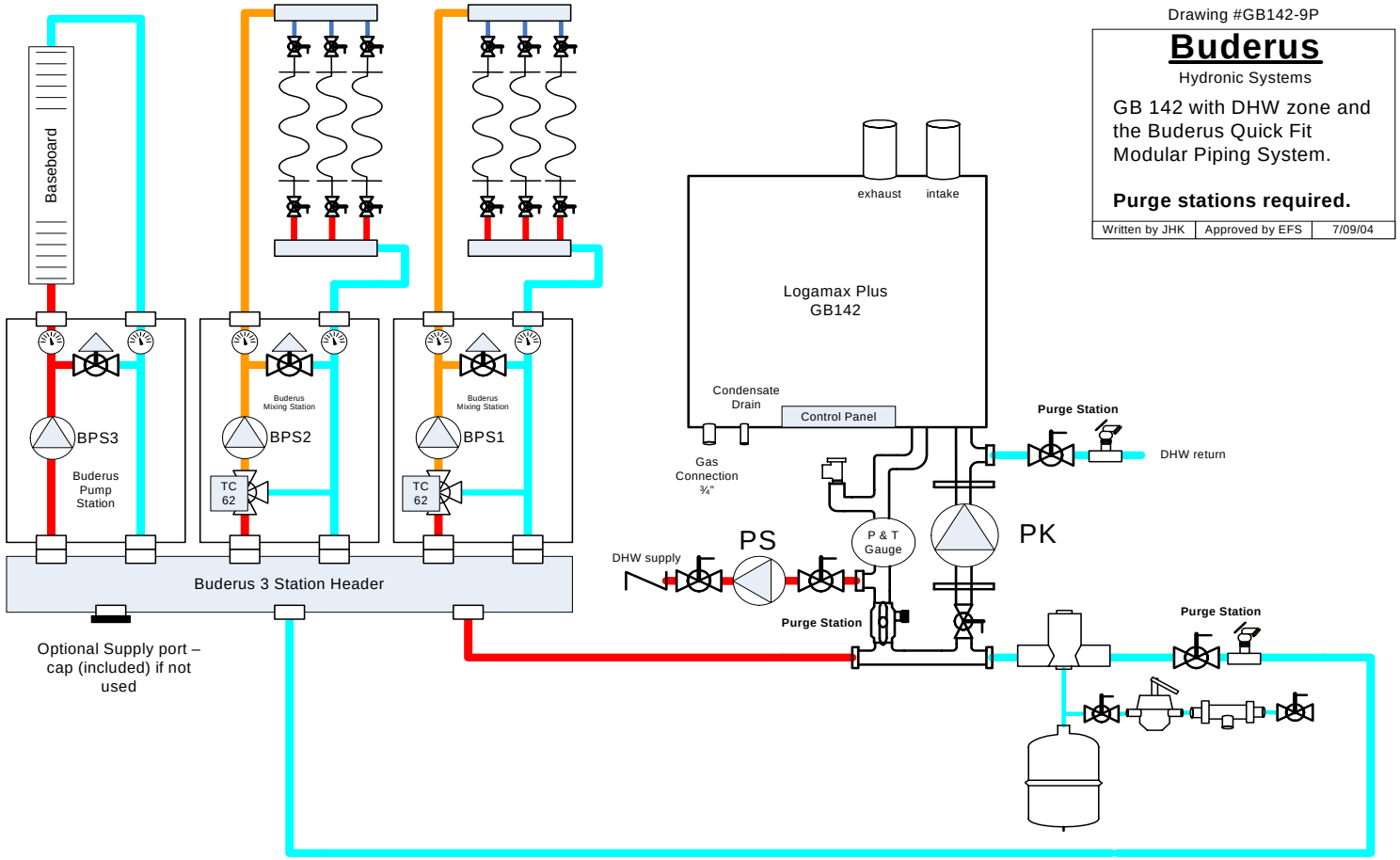


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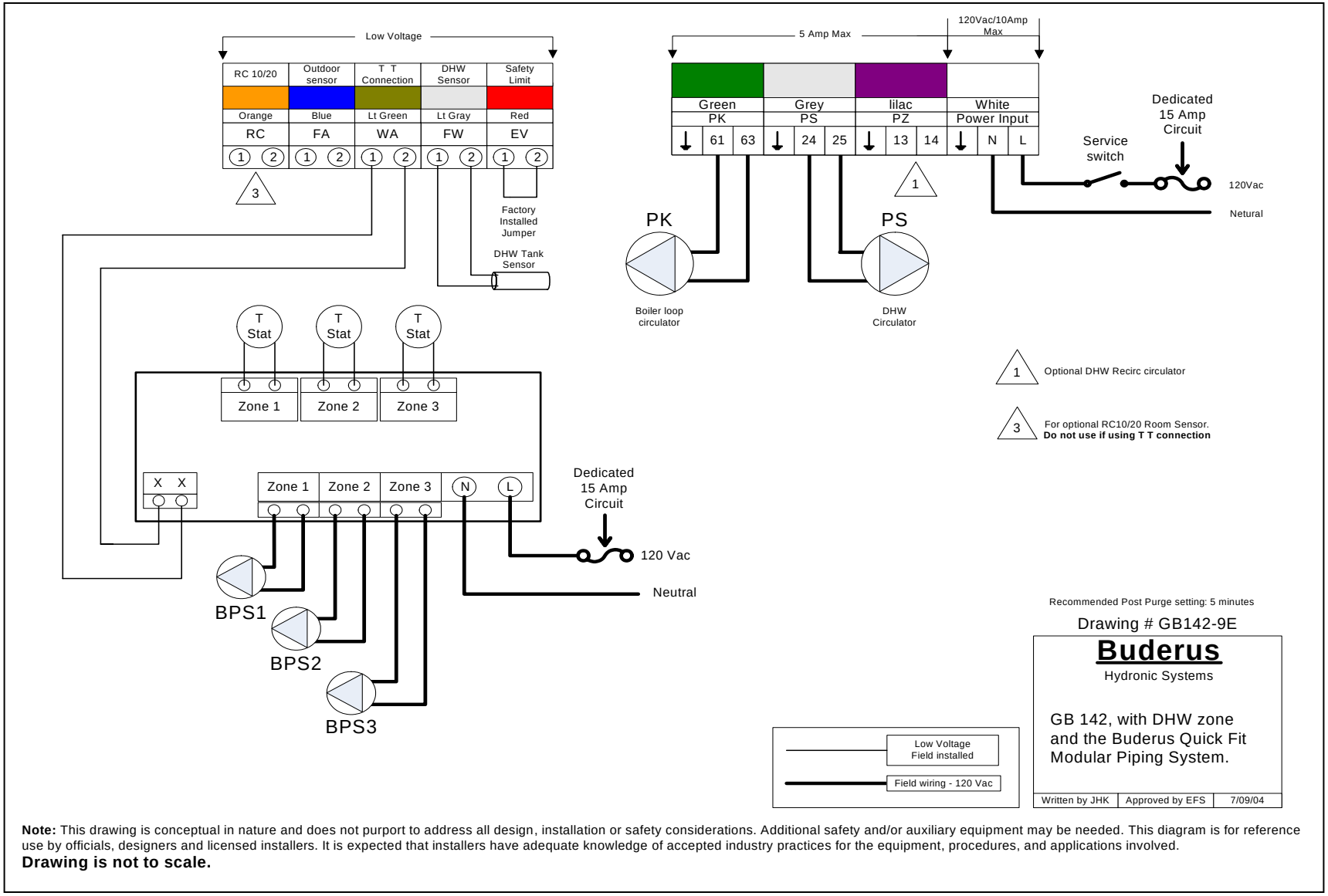


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**Drawing is not to scale.**

Buderus

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